

Program Project Report (PPR)
MASTER OF COMPUTER APPLICATIONS

Assam Don Bosco University
Guwahati
Assam, India

1. INTRODUCTION

The Master of Computer Applications (MCA) through Directorate of Distance Education, Assam Don Bosco University (ADB U) aims to extend quality education to students groups including professional people. Its main objective is to provide quality education relevant to application development by incorporating latest technology and trends. The distance education program on MCA has been designed in such a way that it meet the all the criteria to award a student with MCA degree and also to meet the industry standard.

The course is meant for students who are passionate about IT Jobs. In order to achieve these objectives ADBU developed a curriculum of M.C.A. to meet these challenges.

The scope of MCA

- To make the students ready as per the requirement of Industry and to meet the challenge of sector jobs with the standards of international and business operations.
- Strengthen the knowledge of candidates in various fields including logical development, programming skills, web development, database management, software engineering, project handling, team work proficiency etc.

Career opportunities

With M.C.A. degree, a student can opt for any career as mentioned below,

- Programmer,
- Software Developer,
- DB Administrator,
- Network Engineer,
- Web designer
- Testing Engineer
- Teacher/Professor etc.

Teaching pedagogy

- Course intimation sheet which includes course schedule, objective, module coverage and assessment process
- Video Lectures
- Case studies & Project based approach
- Periodic monitoring and mentoring for learning activities
- Formative quiz & Reflection spot
- Faculty live interactions & Industry connect
- Discussion Forum
- Reading material for self study
- Quiz, assignments and case study for grading purpose

Academic counseling

In order to provide academic assistance to students, academic counselors are engaged for student support services and Personal Contact Programme (PCP).

2. PROGRAMME EDUCATION OBJECTIVES

- I. To prepare the students to have strong foundation in computer science engineering with impetus to higher studies, consultancy, research and development.
- II. To prepare the students to be self sustainable and proficient to meet the real world challenges ethically and responsibly, in service to socio-economic development of the society.
- III. To inculcate the spirit of life-long learning, understanding, and applying new ideas and technologies to provide novel engineering solutions in the rapidly changing environment.

3. RELEVANCE OF THE PROGRAMME WITH HEI'S MISSION AND GOALS

The MCA program offered at Directorate of Distance Education, Assam Don Bosco University aims to impart unique learning experience with practical experiences in industry relevant courses which are most sought in Information technology. The MCA program offered by the University in distance learning mode is aligned with the vision and mission of Assam Don Bosco University.

The vision of Don Bosco University is to mould young persons into intellectually competent, morally upright, socially committed and spiritually inspired citizens at the service of India and the world of today and tomorrow, by imparting holistic and personalized education.

Guided by this vision and leveraging its century-old expertise in education in India and abroad, Assam Don Bosco University is envisaged to be a centre of excellence in study and research focusing upon the following:

- Providing easier access to higher education for the under-privileged.
- Harmonizing technical excellence with human and religious values.
- Employment-oriented courses in emerging areas of contemporary technology and service.
- 'Teacher Education' as a privileged area of interest to accelerate the pace, reach and quality of education.
- Impetus to research initiatives with practical and social relevance.
- Providing a forum for debate and research on key human issues like religion & culture, peace & justice.
- Contributing to the socio-economic development of North-East India.
- Boosting international linkages and collaboration in university education.

The spirit of the university has been encapsulated in its emblem which has five distinct

elements:

- The Cross' signifies its underlying Christian inspiration;
- 'The Profile of St. John Bosco' denotes its distinctive educational philosophy;
- 'The book emphasizes its commitment to academic excellence;
- 'The rays of the Rising Sun' stand for its dynamism and commitment to society; and,
- The motto, 'Carpe Diem' which meaning 'Seize the Day' challenging every Bosconian to grasp the opportunities presented by each new day and attain 'life in its fullness.'

Similarly, mission of Assam Don Bosco University is to Built on a great legacy inherited from our founding fathers, our mission is to create an environment of stimulating intellectual dialogue across disciplines and harvest knowledge with a cutting-edge through high quality teaching, research, and extension activities leading to the generation of students who would provide leadership, vision and direction to society which is again aligned with the mission of MCA program under Distance Education.

Also the Goal of Assam Don Bosco University is to realize this vision by 2025. Our strategy is to develop innovative programmes in basic and emerging disciplines in a phased manner and to update them periodically so as to keep ourselves on track and on time. Our commitment is to involve the faculty and students in interactive learning environment both within and outside the University through contextual and experiential programmes so that they would be builders of a worldwide- network of knowledge-sharing and excel in their performance with a winning edge in the wider context of globalization

4. NATURE OF PROSPECTIVE TARGET GROUP OF LEARNERS

This Program is designed to target working individuals who wish to further their professional and academic qualifications, or wish to acquire domain specific knowledge and skills in their chosen profession or industry, in the field of IT and Software.

It also target the learners form special target group for Directorate of Distance Education. The special target group includes employees, PWD, Transgender, Defense paramilitary forces and prison inmates etc.

5. APPROPRIATENESS OF PROGRAMME TO ACQUIRE SPECIFIC SKILLS AND COMPETENCE

A IT program of this nature is apt for delivery in the online mode, given its practical nature. It's students, who would already be working in the Software/IT industry, shall benefit from putting into practice their learning on an ongoing basis, and shall be able to recognize aspects and applicability of their studies in their everyday work life.

The course is designed in such a way that it can impart the following to its target group,

- conceptual knowledge,
- logical and analytical reasoning ability

- An opportunity to upgrade academic qualifications
- The accessibility of available resource archives in flexible time and environment
- The program is designed with personalized and motivated towards self-directed learning experiences
- As the technology is advanced, professionals are expected to demonstrate working in distributed collaborative environment, where the Distance learning of ADBU ensures the same with collaborative (online) peer learning environment.
- All the engagement related to assignments, case study and projects are designed to meet the requirements of industry and business
- Also to enhance the technical knowledge of the learners

6. INSTRUCTIONAL DESIGN

a. *Curriculum Design*

- Curriculum of the course has been designed as per the existing curriculum of the University . Also it has been designed as outcome based education for which it always emphasized on students learning outcome
- Curriculum also provides the scope for students engagement through various quiz, assignment etc.
- It is developed with learner-centric approach
- Syllabus has been approved by Board of Studies (BoS) members which consists of both Internal and external members (Industry experts) then it has been approved by Academic council.

b. **For Online Mode:**

E-Learning Materials Quality Standard:

The online courses should comply with the following Quality standards, namely:-

The courses should follow the following four quadrant approach, as per the SWAYAM Guidelines:-

Quadrant-I is e-Tutorial; which shall contain: Video and Audio Content in an organized form, Animation, Simulations, video demonstrations, Virtual Labs, etc, along with the transcription of the video.

Quadrant-II is e-Content; which shall contain; self-instructional material (digital Self Learning Material), e-Books, illustrations, case studies, presentations etc, and also

contain Web Resources such as further references, Related Links, Open source Content on Internet, Video, Case Studies, books including e-books, research papers and journals, Anecdotal information, Historical development of the subject, Articles, etc.

Quadrant-III is the Discussion forum; for raising of doubts and clarifying the same on real time basis by the Course Coordinator or his team.

Quadrant-IV is Assessment; which shall contain; Problems and Solutions, which could be in the form of Multiple Choice Questions, Fill in the blanks, Matching Questions, Short Answer Questions, Long Answer Questions, Quizzes, Assignments and solutions, Discussion forum topics and setting up the FAQs, Clarifications on general misconceptions.

c. Duration of the Program

The Master of Computer Applications programme is to be normally completed in 2 years, each year having 2 semesters. The total credits of the courses for one semester is 20. Hence the MCA program will have 80 credits. .

d. Faculty and Support Staff Requirement

As per the directives of UGC(ODL & OL) Regulations, 2020, required administrative, academic and technical staff have been appointed.

For the Centre for Online Education the following are functioning:

Director, Deputy Director, Assistant Director

The **Academic Faculty present** are: Three full-time faculty members have been appointed for online programs

The **Administrative staff** present are : Deputy Registrar, Assistant Registrar, Section Officer, two Assistants, two Computer operators, two Multi Tasking Staff

For **Delivery of Online Programmes (LMS & Data Management)**, the following are present: One Technical Manager and two Technical Assistants

For handling **Admission, Examination and Result**, there is a Technical Manager and two Technical Assistants

The **Technical Team for Development of e-Content - Self-Learning e-Modules** consists of: One Technical Manager (Production), one Technical Associate (Audio-Video recording & editing) and one Technical Assistant (Audio-Video recording)

Academic Faculty & Student Support from the Department of Computer Applications at the Campus, the following are involved: One Program Coordinator, three Course Coordinators and one Course Mentor.

e. Instructional Delivery Mechanisms

Courses to be delivered in an 'online' mode with learning material in the form of E-SLM's, and Self Assessments being available for the students. Additionally, virtual live lectures and recorded lecture sessions to be provided as per a fixed schedule towards the end of each term.

It comprises of the following support services:

- Self-learning material
- Assignments
- Study materials like video lectures, reading materials, reference materials from online sources etc.
- Digital library resources
- Scheduled online classes
- Webinars
- Online discussion forums etc.

f. Student Support Systems

Learner Support Service via Web, Chat, Call Support. Access to counselors at Department on University campus. Access to E-Learning Library resources in the student portal.

g. Personal Contact Programme (PCP)

Online Personal Contact Programme (PCP) are held on time to time basis for doubt clearance with respect to various aspects.

h. E- Learning Portal

ADBU LMS portal has been introduced for the learners for various activities related to assignment submission, class conduction, to conduct examination and to monitor various activities of the students.

7. PROCEDURE FOR ADMISSIONS, CURRICULUM TRANSACTION AND EVALUATION

a. Admission Policy

Admissions to be conducted twice a year (January and July), and as per common regulation for online programs already in place and in effect at the time, in conjunction with UGC Regulations.

b. Minimum Eligibility

As per common regulation for online programs already in place and in effect at the time, in conjunction with UGC Regulations.

c. Fee Structure

As per fee structure in place for online programs, and as decided by fee committee from time to time.

d. Programme Delivery Methodology

Courses to be delivered under the 'online' mode of learning, with students being provided Self learning material in eBook format, along with access to online Self Assessment tools. Contact Programs Sessions to be conducted online once per semester.

e. Web Based Tools

A Web based Portal which shall allow the student access to the following

- Admission & Enrolment Details
- Fee Details and Online Fee Payment Gateway
- Prospectus, Regulations & Syllabus⁰
- Notifications (Admissions, fees, examinations etc)
- Course List, with completion status and scores / results
- eBook's of SLM's.
- Self Assessment Tests (unscored)
- Internal Assessments - IA1 & IA2
- Online PCP Lectures (Recorded or via Virtual Classroom session) as conducted each semester.
- Online Learners forum, for student to student interaction.
- Online Copy of the Grade sheet.
- Access to online support in the form of web chat, ticketed email support etc.

f. Evaluation Methodology – Tools & Methods

Internal Assessment marks to comprise the results of Internal Assessment Tests (IA1 & IA2) over the duration of the Semester/Term towards 30% of the final marks, whereas the End Term Assessment , conducted at Examination centres (as per UGC Regulations) to comprise of the remaining 70%.

End Term Exam Regulations to be as per regulations governing on campus programs.

Being an online program, there shall be no provision or requirement to repeat or drop a year within the program.

8. Requirement of the laboratory support and Library Resources

Practical Subjects in this subject can mostly be covered with access to a computer, internet and software tools (available under FOSS/Open Source). Students may be asked to make arrangements for the same at their own cost.

As per the syllabus/curriculum, should there be need for special equipment/laboratory access (other than the above mentioned regular computer lab or internet connectivity), the same shall be arranged by student on their own which shall be notified by prior intimation.

Provisions also shall be made for access to virtual lab's and simulators via the students online study portal.

Library resources can be accessed online.

9. Cost Estimate of the Programme and the provisions

Upon receipt of approval from the UGC, the Finance Committee may set aside budgetary provisions towards Programme Development, Programme Delivery, Programme Maintenance. Once the programs are operational, fee receipts from the program may be used to cover the same, as per the guidance of the Syndicate and Finance Committee.

10. Quality Assurance mechanism and expected programme outcomes

The expected outcome from these programs is a measurable increase in the skills and knowledge of the student in his/her area of study, and that increase should be reflected in a proportional increase in available job opportunities / role or profile changes in his or her current job or industry, and a change / increment in earning capability .

A Centre for Internal Quality Assurance shall be setup within 1 year of the launch of these programs (as per UGC requirements). The CIQA, working in collaboration with the Department, shall put in place a continuous quality measurement and improvement framework, using both student – teacher feedback, and outcome measurement on data gathered from students during and after completion of their programs via surveys. The findings, action taken report and results shall be published and made available via the CIQA each year in the form of a report.

Learning Assessment Procedure

The student's performance in each course, is evaluated based on continuous assessment for various evaluation including quiz, assignment, end semester examination.

The end-semester examination shall have assessment based on Blooms taxonomy which includes the following,

- a. Remembering

- b. Understanding
- c. Applying
- d. Analysing
- e. Evaluating
- f. Creating

10. CURRICULUM

Program Structure of Master of Computer Applications

SEMESTER I

Category	Course Title	Total Credit
Departmental Core(DC)	Mathematical Foundation for Computer Science	4
Departmental Core(DC)	Theory of Computation	4
Departmental Core(DC)	Operating Systems	4
Departmental Core(DC)	Data Structures and Algorithms	4
Departmental Elective (DE)	Programming Through Java	4
Departmental Elective (DE)	Programming & Problem Solving through C	4

SEMESTER II

Category	Course Title	Total Credit
Departmental Core(DC)	Software Engineering	4
Departmental Core(DC)	Advanced Database Management Systems	4
Departmental Core(DC)	Data Communication and Computer Networks	4
Departmental Core(DC)	Internet Technology and Applications	4

Departmental Elective (DE)	Sensor Networks and Internet of Things	3
Departmental Elective (DE)	Computer Graphics	4

Semester III

Category	Course Title	Total Credit
Departmental Core(DC)	Enterprise Resource Planning	4
Departmental Core(DC)	Cyber Law and IT Security	4
Departmental Core (DC)	Research Methodology and IPR	2
Departmental Elective (DE)	Elective I- Artificial Intelligence	4
Departmental Elective (DE)	Elective II- Data Science	4
Departmental Elective (DC)	Web Programming	4

Semester IV

Category	Course Title	Total Credit
Departmental Core(DC)	Project Work	18

11. DETAILED SYLLABUS

Course Name- MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

Objective

To introduce the concepts of mathematical logic, 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. Another objective would be to understand the concept of combinatorics and apply it in solving problems. To apply the concept of graph theory in solving different 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)

Module I:

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:

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, Semigroups 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:

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:

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 NarsinghDeo, 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 with Syllabus

CourseOutcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	M		
CO2		H		
CO3			H	
CO4		M	H	H
CO5		M	M	H
CO6				M
CO7		M		H

Course Name- THEORY OF COMPUTATION

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: Explain the concepts, core terms and tools used in automata theory (Understanding)

CO3: Make use of techniques, components and tools of a typical automated machine and apply it in designing new machines (Applying)

CO4: Choose which input pattern would be accepted by a Turing Machine, Pushdown Automata, Finite Automata etc. (Applying)

CO5: Compare and contrast various types of machines in Automata theory and relate it to everyday appliances like washing machines, fans, etc (Analysing)

CO6: Design automata and evaluate it in terms of correctness, computation cost and complexity. (Evaluating)

CO7: Design new automata for given problems by using most appropriate algorithmic strategy considering the problem domain. (Creating)

Module I : Theory of Automata

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 NFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II: Formal Languages, Regular Sets and Regular Grammars

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

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

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. Ullamn, 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 with Syllabus

CourseOutcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	M		
CO2		H		
CO3			H	
CO4		M	H	H
CO5		M	M	H
CO6				M
CO7		M		H

Course Name-OPERATING SYSTEMS

Objective

The main objective of this course is to familiarize students with the Operating Systems layer of software, whose primary function is to control and coordinate all of the computer's hardware components and provide user applications with a straightforward interface to those components. Students will get an understanding of processes, memory management, file management, I/O management, and the possible issue of deadlocks during this course. Linux, a full-fledged Unix clone that is quickly gaining popularity around the world, will also be covered, giving the pupils a well-rounded education.

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: Explain how the file system, mass storage and I/O are handled in a modern computer system. (Remembering, Understanding)

CO6: Determine the concepts learned with case studies of Linux and Windows. (Evaluating)

Module I: Concepts, Processes and Threads

Introduction to Operating system, 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, Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation

of Processes, Process Control Block), Threads, 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.

Module II : Deadlocks and Memory Management

Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.

Introduction to memory management, 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, Modeling Paging Algorithms , Design issues for Paging Systems, Implementation issues, Segmentation.

Module II :Input/output and File Systems

Principles of I/O hardware, Principles of I/O software, I/O Software Layers, Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, 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 , Protection mechanisms ,Type of File Systems (FAT, VFAT, FAT32, NTFS)

Module IV :Introduction to Linux OS design – Case study

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) Pte.
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	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H			
CO3		H		
CO4		H		
CO5			H	
CO6				H

Course Name- DATA STRUCTURES AND ALGORITHMS

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 data structures 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 this course students will be able to:

CO1: Know the formal definition of algorithms, importance of analysis of an algorithm and get familiar with different types of problems and their solutions. (Remembering and Understanding)

CO2: Choose appropriate data structures 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 analyze algorithms for given problems. (Applying)

CO5: Compare and analyze 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:

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, Basicsof Algorithms Analysis, Asymptotic Analysis, Mathematical Analysis of Iterative and Recursive Algorithms, Empirical Analysis of Algorithms, Modelsof Computations-RAM model, Turing Machine.

Module II:

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:

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:

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:

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, 3rd Edition, The MIT Press, 2009.
4. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2008.

Mapping of Cos with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M			
CO2	M	H			
CO3			H		
CO4		M	H	H	
CO5			M	M	H
CO6		M	H	M	

Course Name-Programming Through Java

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

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

CO 1: Do Object Oriented Programming using Java

CO 2: Implement Exception handling and Multithreading in Java.

CO 3: Create Java I/O Applications and Applets.

CO 4: Set up a GUI using Swing components

CO 5: Do Network Programming in Java.

CO 6: Access relational databases from the Java program and use Java Beans and Servlets.

Module I: Core Java Programming

- a) 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),
- b) Java language fundamentals: The scope and lifetime of variable, Type conversion

and casting, Control statements, Arrays

c) 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

a) Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the Object class; Packages, Interface, classpath

b) Exception handling: Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions.

c) Multithreaded Programming: The Java thread model (thread priorities, synchronization and inter-thread communication); Deadlock, Thread Group

d) 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

a) String handling: String constructors, methods for character extraction, string searching and comparison, data conversion using valueof (), StringBuffer.

b) Exploring java.lang: Simple type wrappers, System class, class Class, Math functions

c) The utility classes: Vector, Stack, HashTable, StringTokenizer, Bitset, Date, Calendar, Gregorian Calendar, Random, Observable

d) 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 (FileInputSream, FileOutputStream, BufferedInputStream, BufferedOutputStream, PushBackInputStream, InputStreamReader, BufferedReader, BufferedWriter, PrintStream, RandomAccessFile)

Module IV: Networking, Images, Applet class and Swing

a) Networking: Socket overview, Stream Sockets, Datagram sockets, Manipulating URLs, establishing a simple Server/Client using Stream Sockets, Connectionless Client/Server Interaction with Datagrams

b) Images: File formats, image fundamentals, creating, loading and displaying images, ImageObserver, MediaTracker

c) 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
i) Swing: Component and Container classes, Layout managers (FlowLayout, GridLayout, BorderLayout),

Handling events, Adapter classes, Anonymous inner classes

ii) Swing GUI components: JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame
iii) Menus: JMenuBar, JMenu, JMenuItem, JSeparator

Module V: Java Beans, JDBC, Java Servlets

a) 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

b) 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 Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	L		
CO2		M		
CO3		M	H	
CO4			M	H
CO5				L

Course Name-PROGRAMMING & PROBLEM SOLVING THROUGH C

Objective

This course introduces programming in C language to help students develop critical thinking and problem-solving skills. This course will help students grasp concepts such as functions, pointers, and file handling, which are essential in various programming contexts. After completing this course, students will become familiar with fundamental programming concepts and gain transferable skills that can be applied to other languages and programming paradigms.

COURSE/LEARNING OUTCOMES

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

CO1:Students will grasp foundational programming concepts such as variables, data types, and other programming constructs.(Understand)

CO2:Students will learn to apply branching and looping statement to solve problems involving decision making.(Apply)

CO3:Students will learn to evaluate the efficiency of their programs constructed using user-defined functions with different parameter passing techniques.(Evaluate)

CO4:Students will be able to create programs using pointers and store and retrieve the program data using file handling. (Create)

Module I: Overview of C

Importance of C, Basic structure of C Programs, Basic programming constructs- character set, tokens, Constants, Variables, and Data Types, Keywords and identifiers, symbolic constants. arithmetic, relational, logical, increment and decrement, conditional, bitwise, Expression, precedence of operators, type conversion and casting, mathematical functions, Managing Input and Output Operations - Reading a character, writing a character, formatted input, formatted output.

Module II: Decision Making and Branching

If statement – Different forms of if statement, switch, break and continue, Looping statements in C – For, while and do while, nested loops, Structured data types in C – Array – One dimensional and two-dimensional array, String, Structures and union.

Module III: User-Defined Functions

Need for user-defined functions, multi-function program, general form of C function, Category of functions, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays and Structures, The scope and lifetime of variables in functions.

Module IV: Pointers and File Handling

Understanding pointers. Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer. File Handling– Definition and need of file. Defining, Opening, and Closing a file. Input and output operations on files. Random access to files with example programs.

Suggested Readings:

8. Problem Solving with C, Somashekara M. T, PHI.
9. Programming in ANSI by E. Balagurusamy, TMH.

Mapping of Cos with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	L		
CO2	M	H		
CO3		M	H	
CO4		M	L	H

Course Name- SOFTWARE ENGINEERING

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

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

- CO 1: Define the lifecycle models of software. (Remembering)
- CO 2: Explain, identify and differentiate various software lifecycle models (Understanding)
- CO 3: Analyse and design the software requirements specification and perform risk management and testing. (Analysing)
- CO 4: Develop and create various design diagrams and find solutions to problems. (Creating)

Module I :

- a. The Product and The Process: The Product-Evolving Role of Software, Software (Characteristics, Components and Applications);
- b. 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;

c. Project Management Concepts – The Management Spectrum (People, the Problem, the Process and the Project);

d. 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;

e. 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:

a. 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;

b. 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;

c. Software Quality Assurance - Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQAPlan, The ISO 9000 Quality Standards;

d. Software Configuration Management- Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting;

e. System Engineering- Computer Based Systems, Product Engineering

Module III:

a. Analysis and Design: Analysis Concepts and Principles- Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review;

b. 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;

c. 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;

d. Design Methods- Data Design, Architectural Design, the Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;

e. Design For Real Time systems- Real Time Systems;

f. Case studies on diagram- Use case, Class, Activity, Sequence

Module IV:

- a. 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;
- b. Software Testing Strategies- A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging;
- c. 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:

- a. 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
- b. Object Oriented Analysis- Object Oriented Analysis, Domain Analysis, Generic Components of the Object Oriented Analysis Model, the OOAP Process, the Object Relationship Model, the Object Behavior Model
- c. Object Oriented Design- Design for Object Oriented Systems, The Generic Components of the OODesign Model, The Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming
- d. Advanced Topics in Software Engineering: Cleanroom Software Engineering- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing
- e. Software Reuse - Management Issues, the Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse
- f. Reengineering-

Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering

- g. 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 Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	L			
CO2	H	M	H		
CO3		H	M	H	
CO4			H		M

Course Name- ADVANCED DATABASE MANAGEMENT SYSTEMS

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 modelling 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: Recall the core terms, concepts, and tools of database management systems. (Knowledge)

CO2: Discuss relational data models, ER_models, transaction processing systems, database recovery, and database security issues. (Understand)

CO3: Use relational algebra based queries for data retrieval, data manipulation, and database management. (Apply)

CO4: Analyze functional dependencies, high level queries, concurrency control techniques for ensuring serializability, and transaction processing. (Analyze)

CO5: Design database management systems including ER-diagrams and schema diagrams for real world problems. (Create)

Module I: Introduction

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

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

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

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

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, Lock- based techniques for concurrency control, Graph-based protocol, Timestamp based protocol, Deadlock, Deadlock prevention methods, Deadlock detection Deadlock recovery.

Module VI: Recovery and Security

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 with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	L			
CO2		L	L		M	H
CO3		H		M	H	
CO4			M	H	H	
CO5	L	H	H	L		

Course Name- DATA COMMUNICATION AND COMPUTER NETWORKS

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/LEARNINGOUTCOMES

At the end of this course 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 William Stallings, Data and Computer Communications (Sixth Ed.), Prentice Hall of India, 2000
3. Fred Halsall, Data Communication, Computer Networks and Opens Systems, (4th Ed.), Pearson Education, 2000 William Stallings, Cryptography and Networking Security - Principles and Practice, Pearson

Mapping of COs with Syllabus

CourseOutcomes	Module 1	Module 2	Module 3	Module 4
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CO1	H			
CO2		H		
CO3			H	
CO4		M	H	H
CO5		M	M	H
CO6				M

Course Name: INTERNET TECHNOLOGY AND APPLICATIONS

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 are 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 deploy a website of their own. (Evaluating)

Module I: Introduction to Internet

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

- a. XHTML: What is XHTML? Components of XHTML; Elements of XHTML (Headers, Paragraphs, b. Linking, Images, Special Characters, Lists, Tables, Forms, Framesets) c. Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow) d. 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 Language

a. 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. b. Databases: Introduction to each one of the following: SQL, MYSQL, DBI c. 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 d. Java Servlets: Servlet overview and architecture, Servlet Interface, and Servlet life cycle, HTTP Servlet Class, HTTP ServletRequest Interface, HTTP ServletResponse 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

a. 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. b. 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

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H			
CO3			H	
CO4		M		H
CO5		M		H
CO6		M		H

Course Name-SENSOR NETWORKS AND INTERNET OF THINGS

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/LEARNINGOUTCOMES

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

CO1:Explain the definition and usage of the term “Internet of Things” in different contexts and understand the key components that make up an IoT system (Remembering)

CO2:Understand why it is necessary to build a separate model for IoT and what parameters influences the operation of IoT network. (Understanding)

CO3: Apply the knowledge in designing IoT network for addressing real life issues for easing the day to day life activities. (Applying)

CO4: Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.(Applying)

CO5: Know what type of sensor protocols and architecture to adopt for efficient communication and what services offline and online to be used for problem solving. (Analyzing)

Module I:

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics; IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Module II :

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, a use case example, Differing Characteristics. Definitions, M2M Value Chains, IoTValue Chains, An emerging industrial structure for IoT

M2M vs IoT An Architectural Overview–Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

Module III :

IoT Architecture: Introduction, Reference Model, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. IoT with Arduino: Hands on Experience with Arduino (Firmware development & RTOS) - General Purpose I/O(GPIO), Serial Communication Interfaces: RS-232/485, Synchronous Peripheral Interfaces: I2C, SPI Sensors interfacing with Arduino. IoT with Raspberry PI: Hands on Experience with Raspberry PI (Firmware development) - 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: Wireless Sensor Networks (WSNs), Introduction to WSNs Topologies in WSNs; Wired Communication Protocols – Ethernet, Serial Communications; Wireless Communication protocols Wifi, RF, IPV4/V6, 6LOWPAN, ZigBee(IEEE802.15.4), BLE, GSM(2G/3G/LTE).

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 ZnatiTaieb, Wireless sensor networks: technology, protocols, and applications. John

Mapping of Cos with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3			H	M
CO4			H	
CO5				H

Course Name- INTERNET TECHNOLOGY AND APPLICATIONS

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 are 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 deploy a website of their own. (Evaluating)

Module I: Introduction to Internet

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

a. XHTML: What is XHTML? Components of XHTML; Elements of XHTML (Headers, Paragraphs, b. Linking, Images, Special Characters, Lists, Tables, Forms, Framesets) c. Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow) d. 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

a. 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. b. Databases: Introduction to each one of the following: SQL, MYSQL, DBI c. 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 d. Java Servlets: Servlet overview and architecture, Servlet Interface, and Servlet life cycle, HTTP Servlet Class, HTTP ServletRequest Interface, HTTP ServletResponse 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

- a. 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.
- b. 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

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H			
CO3			H	
CO4		M		H
CO5		M		H
CO6		M		H

Course name-Machine Learning

Objective:

The course is intended to give the students an insight into Machine learning technique and its applications in real life problems

Course/Learning Outcomes

- CO 1: Learn mathematical principles used in learning algorithms and relate them to learning principles. (Understanding)
- CO 2: Construct and classify learning algorithms used in different problems. (Applying)
- CO 3: Know what and how to perform pre-processing to make dataset ready for learning algorithms(Analysing)
- CO 4: Create learning models and evaluate the effect of it in a given problem domain. (Evaluation)

Module I

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

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

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

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

Deep learning: Convolutional Neural Network: AlexNet, GoogleNet, ResNet, RNN: Training a RNN, deep RNN, LSTM stacks, autoencoder, stacked autoencoder, sparse autoencoder

Suggested Readings:

1. Python Cookbook-by Alex Martelli, Anna Martelli Ravenscroft, and David Ascher
2. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill, 1997.
3. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.

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			M	M	H

Course Name-Enterprise Resource Planning

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

a) 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 modelling, integrated data model

b) 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

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

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

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

- a) 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.
- b) 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. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India
8. ERP – Concepts and Cases, ICFAI University Press, 2004

Mapping of Cos to Syllabus

CourseOutcomes	ModuleI	ModuleII	ModuleIII	ModuleIV	ModuleV
CO1	H				
CO2		M	H		
CO3		H	M		
CO4		L		H	
CO5					H

Course Name-Cyber Law and IT Security

Course/Learning Outcomes:

CO 1: Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and design real time scenarios. (Applying)

CO 2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of

CO 3: exploitation. (Analyzing)

CO 4: Analyze and evaluate the cyber security needs of an individual/organization. (Analyzing, Evaluating)

CO 5: Design operational and strategic cyber security strategies and policies. (Creating)

CO 6: Analyze various types of cybercrime and formulate procedures for real world cybercrime Investigations. (Analyzing)

Module I

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

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

Domain Name Disputes and Trademark Law: Concept of Domain Names, New Concepts in Trademark, Jurisprudence, Cyber- squatting, Reverse Hijacking, Meta tags, Framing, Spamming, Jurisdiction in Trademark Dispute

Module IV

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

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	Modul el H	Modul ell H	Module III H	Module IV H	Modul eV H
CO1					
CO2					
CO3					M
CO4				H	M
CO5				M	H
CO 6				M	M

Course Name-RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHT

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 fora through intellectual ownership.

Course Outcomes

CO 1: Find research problems in various fields (Remembering).

CO 2: Illustrate the concepts related to patents, trademark and copyright (Understanding).

CO 3: Apply scientific investigations to find solutions for research problems of interest (Applying).

CO 4: Develop technical writing and presentation skills (Applying).

CO 5: Analyze the available literature and compile literature review for knowing the state of the art in the areas of interest (Analyzing/ Creating).

CO 6: Formulate a research problem for a given engineering domain (Creating)

Module I: Research problem formulation and solution

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

Effective writing; Research proposal development and its format; Different report types.

Module III: Intellectual Property Rights

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. Debra, 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

	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

Course Name- Artificial Intelligence

Objective

Artificial Intelligence has embraced the larger scientific goal of constructing information-processing theory of intelligence. If such 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:

CO 1: 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)

CO 2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (Understanding)

CO 3: 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)

CO 4: Compare and analyse the performance of algorithms based on problem domain. (Analysing)

CO 5: Design and create new intelligent algorithms for application development by integrating experience based learning. (Creating)

CO 6: 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

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

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, constraints satisfaction, means-end analysis. game playing: overview, the minimax search procedure, adding alpha-beta cutoffs, additional refinements, iterative deepening.

Module III: Knowledge Representation

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

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.
5. Winston, P. H., Artificial Intelligence, New Delhi: Pearson Education Asia, 2002
6. Charniak, E.; D. McDermott, Introduction to Artificial Intelligence, New Delhi: Pearson Education, 2002
7. Russell, S.; P. Norvig, Artificial Intelligence: A Modern Approach (Second Edition), New Jersey: Prentice-Hall, 2003

Mapping of COs to Syllabus

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H		M	L
CO2	M	H	L	
CO3	L	M	H	
CO4		H	M	M
CO5			H	M
CO6		M	M	H

Course Name- Data Science

Course Objective

The objective of this course is to learn how to use tools for acquiring, cleaning, analyzing, exploring, and visualizing data; making data-driven inferences and decisions; and effectively communicating results

Course Outcomes

CO 1: Recall the fundamental concepts used in data science. (Remembering)

CO 2: Explain the key concepts in data science, including their real-world applications and the toolkit used by data scientists. (Understanding)

CO 3: Apply various statistical techniques to find the underlying facts on various datasets. (Applying)

CO 4: Analyze the different data using statistical and machine learning techniques. (Analyzing)

CO 5: Evaluate the effectiveness of various data visualization techniques for real life applications. (Evaluating)

CO 6: Design and develop various data visualization methods for a given problem. (Creating)

Module I:

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Module II:

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:

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic.

Module IV:

Data visualization: Introduction, Types of data visualization, Data for visualization, Applications of Data Science Technologies for visualization.

Module V:

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Suggested Readings:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O’Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
3. Rafael A. Erizarry. Introduction to data science: Data Analysis and Prediction Algorithms, CRC Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M	M	
CO 2		H	M	M	
CO 3			H		
CO 4			H		
CO 5				H	
CO 6				H	H

Course Name- Web Programming

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies. Finally, the course also provides a basic knowledge of querying web databases to support a website having back-end information.

COURSE/LEARNING OUTCOMES

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

CO 1: Examining the growth of the Internet and recalling the history behind it. (Remembering)

CO 2: Illustrate and differentiate the various services provided by the internet. (Understanding)

CO 3: Experiment with various mark-up languages, stylesheets and scripting languages. (Applying)

CO 4: Analyse and design a website of their own and can also identify the faults in the design. (Analysing)

CO 5: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

CO 6: Develop and create a website of their own. (Creating)

Module I: Basic Internet-related Terms and Static Web Development

a. Basic Terms: History of the Internet and the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet Connectivity; Search Engines, News-group, voice and video conferencing, E-

mail and its Protocols; Web Portal; Different types of browsers (IE, Firefox, Chrome); URLs, Domain names

b. Static Web Development: Introduction to XHTML; HTML vs. XHTML, XHTML comments; Basic Tags-XHTML, HEAD, TITLE, BODY; Paragraph Tag, Horizontal Rule Tag, Headings Tags, Block quote Tag, Lists, Linking, Images, Tables, FONT Tag, PRE, DIV and SPAN tags; other different formatting tags; Forms; Frames

c.

Module II: CSS, DHTML and Java Script

a. Cascading Style Sheets: Types of Style Sheets-Inline, Embedded, and External; Conflicting Styles; Use of CSS for positioning elements, Background, and Text flow, CSS Box Model, CSS Borders and Outlines, Style class and Pseudo-class, CSS Image Gallery

b. DHTML: Introduction to DHTML and JavaScript, JavaScript vs. VBScript, Adding script to documents, Data types, operators, variables, input and output statements, Built in functions, Arrays, If statement, Switch statement, Looping statements, Loops, JavaScript Form Validation, Events in JavaScript

c.

Module III: Website Design Considerations and XML

a. Website Design Considerations: Planning to design a website, sitemaps, top-down vs. bottom up approach, Creating a Compatible website for different color depths, resolutions, and browser considerations, validating a website) XML: Introduction to XML; Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Parser; Document Object Model; Extensible Stylesheet Language (XSL)

Module IV: Web Servers and PHP

a. Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP

b. PHP: Introduction to PHP; PHP Data Types; Control Structures; Functions; Strings; Arrays

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E.A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reilly.
3. 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
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reilly.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3		H	M	
CO4			H	H
CO5			H	L
CO6			H	H

Course Name-MAJOR PROJECT

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:

CO 1: Identify different API and development environment tools for building the project, research terminologies such as scaling, sampling, information gathering etc for research-based project. (Understanding, Applying)

CO 2: Learn different programming languages/research tools needed to meet different objectives of the project based on the company/institutional requirements. (Remembering)

CO 3: 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, classification & clustering techniques, etc. will be applied. (Applying)

CO 4: Analyse the advantages and limitations of different development languages, APIs, platforms, algorithms (for research) (Analysing)

CO 5: Create applications to meet real time needs. For research-based projects, students will be able to design novel or hybrid research techniques to meet the problem statement objectives (Creating)

CO 6: Judge the efficiency of the project using various evaluation parameters and testing methodologies, efficiency of the algorithm for researchbased (complexity measure) (Evaluating)