



Department of Computer Applications

3 YEARS MCA PROGRAMME

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PART - I

COURSE STRUCTURE

FIRST YEAR
FIRST SEMESTER

A. Theory							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP1101	Introduction to Programming	3	1	0	4	4
2	MCAP1102	Mathematical Foundations	3	1	0	4	4
3	MCAP1103	Numerical Analysis	3	1	0	4	4
4	HMTS1101	Accounting and Management Control	3	0	0	3	3
5	HMTS1102	Oral and Written Communications	3	0	0	3	3
Total Theory						18	18
B. Laboratory							
6	MCAP1111	Programming Lab	0	0	4	4	3
7	HMTS1112	Communications Lab	0	0	4	4	3
Total Practical						8	6
Total of Semester						26	24

SECOND SEMESTER

A. Theory							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP1201	Computer Organization and Architecture	3	1	0	4	4
2	MCAP1202	Data Structures	3	1	0	4	4
3	MCAP1203	Database Management Systems I	3	1	0	4	4
4	MCAP1204	Information System Analysis Design and Implementation	3	1	0	4	4
5	MCAP1205	Probability and Statistical Computing	3	1	0	4	4
Total Theory						20	20
B. Laboratory							
6	MCAP1211	Digital Logic and Computer Architecture Lab	0	0	4	4	3
7	MCAP1212	Data Structures Lab	0	0	4	4	3
8	MCAP1213	DBMS I Lab	0	0	4	4	3
Total Practical						12	9
Total of Semester						32	29

SECOND YEAR

THIRD SEMESTER

A. Theory							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP2101	Object Oriented Programming with Java	3	1	0	4	4
2	MCAP2102	Database Management Systems II	3	1	0	4	4
3	MCAP2103	Operating Systems	3	1	0	4	4
4	MCAP2104	Design and Analysis of Algorithms	3	1	0	4	4
5	MCAP2105	Optimization Techniques	3	1	0	4	4
Total Theory						20	20
B. Laboratory							
6	MCAP2111	Object Oriented Programming Lab	0	0	4	4	3
7	MCAP2112	DBMS II Lab	0	0	4	4	3
Total Practical						8	6
Total of Semester						28	26

FOURTH SEMESTER

A. Theory								
Sl.	Code	Subject	Contacts Periods/Week				Credit Points	
			L	T	P	Total		
1	MCAP2201	Computer Communication Networks	3	1	0	4	4	
2	MCAP2202	Web Technology	3	1	0	4	4	
3	MCAP2203	Artificial Intelligence and Applications	3	1	0	4	4	
4	MCAP2250- MCAP2253	Elective I	3	1	0	4	4	
	MCAP2250 MCAP2251 MCAP2252 MCAP2253	Soft Computing Mobile Computing Compiler Design Management Support System						
	5	MCAP2260- MCAP2264	Elective II	3	1	0	4	4
	MCAP2260 MCAP2261 MCAP2262 MCAP2263 MCAP2264	Advanced UNIX Programming Cloud Computing Cryptography and Network Security Ecommerce and ERP Foundations of Decision Processes						
Total Theory						20	20	
B. Laboratory								
6	MCAP2211	Computer Network Lab	0	0	4	4	3	
7	MCAP2212	Web Technology Lab	0	0	4	4	3	
Total Practical						8	6	
C. Sessional								
8	HMTS2221	Career Development and Management	0	0	3	3	2	
Total Sessional						3	2	
Total of Semester						31	28	

THIRD YEAR
FIFTH SEMESTER

A. Theory							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP3101	Software Engineering	3	1	0	4	4
2	MCAP3102	Computer Graphics and Multimedia	3	1	0	4	4
3	MCAP3150- MCAP3153	Elective III	3	0	0	4	4
	MCAP3150	Distributed Database Management					
	MCAP3151	Machine Learning					
	MCAP3152 MCAP3153	Management of Software Projects Blockchain Technology & Applications					
4	MCAP3160- MCAP3163	Elective IV	3	0	0	4	4
	MCAP3160	Image Processing					
	MCAP3161	Data Mining & Data Warehousing					
	MCAP3162 MCAP3163	Managerial Economics Internet of Things					
Total Theory						16	16
B. Laboratory							
5	MCAP3111	CASE Tools Lab	0	0	4	4	3
Total Practical						4	3
C. Sessional							
6	MCAP3195	Minor Project and Seminar	0	0	12	12	9
Total Sessional						12	9
Total of Semester						32	28

SIXTH SEMESTER

A. Sessional							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP3295	Major Project & Seminar	0	0	29	29	24
2	MCAP3296	Comprehensive Viva	0	0	0	0	4
Total Sessional						0	28
Total Semester						29	28

Subject Category-wise Credit Summary for MCA Programme(Excluding Project and Comprehensive Viva

Sl. No.	Course Type	Credit from Compulsory Courses	Credit from Elective Courses (Max)
1	Business Management including Humanities	11	16
2	Information Technology	79	16
3	Mathematics	16	0

Semester Wise Credit Summary for MCA Programme

Semester No.	Contact hr/wk	Credit
1	26	24
2	32	29
3	28	26
4	31	28
5	32	28
6	29	28
Total		163



PART – II
DETAILED SYLLABUS

Syllabus of 1st semester:

Paper Name: INTRODUCTION TO PROGRAMMING					
Paper Code: MCAP1101					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand the flow of control in order to solve a real time problem.
2. Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
3. Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
4. Understand the programming constructs in order to solve a problem of given nature.
5. Apply high-level language to automate the solution to a problem.
6. Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

Module I [10L]

Introduction: History of Computing, Evolution of Programming Languages, Compilers, Familiarization with UNIX.

Problem Solving Method: Algorithm, Flowchart, Problem-Solving Methodology- Tools, Pseudocode.

Overview of C language: C Standards, Structure of a C Program, C Libraries, Steps of Compilation of a C Program.

Expressions: Basic Data Types, Variables, Type Qualifiers, Storage Class Specifiers, Variable Scopes, Constants, Operators, Operator Precedence, Expression Evaluation, Type Conversion in Expressions, Type Casting.

Console I/O: Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O.

Module II [10L]

Control Statements: Selection Statements (if, switch-case), Iteration Statements (for loop, while loop, do-while loop), Jumping Statements (return, goto, break, exit, continue).

Function: Functions and Modular Programming, General Form, Function Prototypes, Library Functions, Parameter Passing Mechanisms, Storage Classes, Recursive function.

Module III [10L]

Arrays and Strings: Single Dimension Arrays, Two Dimension Arrays, Multidimensional Arrays, Strings, Arrays of Strings, String Library Functions.

Pointer: Pointers and Memory Addressing. Pointer Variables, Pointer Arithmetic, Pointer Expressions, Pointers and Arrays, Functions and Pointers, Dynamic Memory Allocation, Command Line Arguments.

Module IV [10L]

Structures, Unions, Enumerations: Structures, Arrays of Structures, Structure and Pointers, Unions, Bit Fields, Enumerations, typedef keyword.

File I/O: Concept of Files, File operations, Text Files and Binary Files.

The Preprocessor: Preprocessor Directives, Macros, File Inclusion.

Text Books:

1. Programming with C - Gottfried, TMH.
2. Programming in C - Balagurusamy, Tata McGrawHill.
3. Programming in C – Reema Thareja, Oxford University Press.

Reference Books:

1. C Programming Made Easy - Raja Ram, SCITECH.
2. The C Programming Language - Kernighan Ritchie, PHI.

Paper Name: MATHEMATICAL FOUNDATIONS					
Paper Code: MCAP1102					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand the basics of Mathematical Logic and how that can be abstracted through logical variables and connectives.
2. Develop the concept of Graphs and their properties with respective algorithms to explore some of the fundamental ideas of Computer Science.
3. Combine the ideas of Permutation & Combination to solve some real world computational problems.
4. Analyze the nature of generating functions and recurrence relations.
5. Understand the Boolean Algebra and its inner working for lower level computation.
6. Develop the basic idea of Automata theory and its significance for the modern theory of Computational Linguistics.

Module I [10L]

Mathematical Logic: Propositions, Connectives, Conditionals and Biconditionals, Well-formed formulas (WFF), Tautologies, Equivalence formulas, Law of duality, Normal Forms, Predicate Calculus, Free and Bound variables.

Abstract Algebra: Set, Relations and Well-ordering principle, Functions. Algebraic structures, Semi-group, Group, Subgroup, Order of a group, Cyclic-group, Homomorphism. Application of residue arithmetic in computer.

Module II [10L]

Graph Theory: Basic Concepts of Graphs-definitions, Walk, Trail, Path, Isomorphic graph, Connected graph, Euler graph. Trees, Forest, Adjacency and Incidence Matrices, Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Shortest Path (Dijkstra's Algorithm), Planar Graph. Storage representation and manipulation of graphs, List-structures. Various applications of Graph Theory in Computer Science.

Module III [10L]

Permutation and Combination: Concepts of Permutations and Combinations, Inclusion-Exclusion Principle, Pigeon-hole principle, Euclidean algorithm for Linear Diophantine Equation, Basic Counting Concepts. Formula derangement, Restrictions on relative positions.

Generating- function and Recurrence relation: Generating-function, Recurrence-relations, Linear recurrence-relations with constant coefficients, Solution by Generating-function.

Module IV [10L]

Boolean Algebra: Definition of Boolean algebra, Boolean function Simplification. SOP and

POS forms.

Mathematical Computing: Finite Automata – definition and construction, DFA, NFA, NFA to DFA conversion, State-minimization, Mealy M/C, Moore M/C, problem and solution.

Definition of Grammars: Unrestricted grammar, Context-sensitive grammar, Context-free grammar, Regular grammar.

Text Books:

1. Discrete Mathematics and Its Applications - KH Rosen, TMH.
2. Elements of Discrete Mathematics -C.L Liu, McGraw Hill.
3. Discrete Mathematical Structure - Kolman, Busby and Ross, PHI.

Reference Books:

1. Discrete Mathematics Theory, Problems and Solutions – Dipendra Nath Ghosh, Academic Publishers.
2. Graph Theory with Application to Engineering and Computer Science - N. Deo, PHI.
3. Theory of Computer Science – K.L.P. Mishra and N. Chandrashekharan, PHI.

Paper Name: NUMERICAL ANALYSIS					
Paper Code: MCAP1103					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Develop the ideas of numerical computations and the various types of errors occur in numerical computations.
2. Apply various Algebraic and Transcendental Equations to solve specific problems of numerical computation with their rate of convergence.
3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. Analyze certain real life problems that can be transformed in terms of numerical differentiation and integration.
5. Apply techniques to solve the system of linear equations.
6. Apply various techniques to solve ordinary differential equations.
7. Analyze the basics of approximation theory through least square method.
8. Develop the ideas of various linear and nonlinear curve fitting techniques.

Module I [8L]

Errors in Numerical Computations: Computing Arithmetic, Sources of Errors, Significant Figures: Absolute, Relative and Percentage Errors. Significant Digits, Generation and Propagation of Round-off Error.

Solutions to Algebraic and Transcendental Equations: Introduction, Bisection Method, Secant Method, Regula Falsi Method , Newton Raphson Method , Iterative or Successive Approximation Method , Comparison of Iterative Methods, Convergence of different methods, Algorithm and Flowchart of different methods.

Module II [10L]

Interpolation and Polynomial Approximation: Introduction, Lagrange's Interpolation , Finite Difference Operators, Error in Interpolating polynomial, Interpolation Techniques Based on Finite Differences , Forward and Backward Differences, Newton's Forward Difference Interpolation Method, Newton's Backward Difference Interpolation Method, Inverse Interpolation .

Module III [12L]

Numerical Differentiation and Integration: Introduction, Differentiation based on Newton's Forward and Backward Interpolation Formula, Different Operators, Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule, Errors in Integration Formulae, Algorithm and Flowchart of different methods.

Solutions to System of Linear Equations: Introduction, Gauss Elimination Method, Gauss Jordan Elimination Method, Triangularization or LU Decomposition Method, Jacobis Iteration Method, Gauss Seidel Iterative Method, Comparison and choice of Methods, Eigen-Value problem, Algorithm of different methods.

Module IV [10L]

Solutions to Ordinary Differential Equation: Introduction, Taylor Series Method, Euler's Method, Modified Euler's Method, Runge Kutta Method, Algorithm of different methods.

Approximation Theory: Least Square Approximation.

Curve Fitting: Curve Fitting using Least Square Method – Linear, Quadratic, Cubic, and Exponential.

TextBooks:

1. Introductory Numerical Analysis – Dutta and Jana, Shreedhar Prakashani.
2. Introductory Methods of Numerical Analysis - S. S. Sastry, PHI

Reference Books:

1. Computer Oriented Numerical Methods - V. Rajaraman, PHI
2. Numerical Analysis and Computational Procedures - S. Ali Mollah, Books & Allied Ltd.
3. Numerical Mathematical Analysis - James B. Scarborough, Oxford.

Paper Name: ACCOUNTING AND MANAGEMENT CONTROL					
Paper Code: HMTS1101					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

1. Understanding the role and purpose of accounting.
2. Ability to prepare, interpret and analyze financial statements.
3. Understanding the various methods of costing and ability to use costing techniques for decision making.
4. Use of budgetary control, standard cost and variance analysis.
5. Thorough knowledge of Management Control Systems that are used to run businesses.
6. Analyze and prepare business data to facilitate management understanding and action.
7. Idea of efficient allocation of organizational resources during budgeting process.
8. Appreciating the need of management reporting for decision making.
9. Understanding Management Control System for different types of organizations.

Module I [8L]

- i. Double entry system of book keeping – Basic accounting equation
- ii. Meaning of assets, liabilities, equity, revenue, expenses
- iii. Accounting concepts and conventions
- iv. Inventory valuation (FIFO, LIFO, Simple Average, Weighted Average method)
- v. Accounting concept and methods of computing depreciation (SLM,WDV)

Module II [12L]

- i. Accounting Cycle - Journal, Ledger and Trial Balance
- ii. Preparation of Final Accounts with common adjustments for public limited companies.

Module III [12L]

- i. Objectives and importance of Cost Accounting
- ii. Basic cost concepts - cost classification; allocation; apportionment; absorption,
- iii. Break-even analysis
- iv. Decisions based on marginal costing – relevant cost; make or buy; product mix
- v. Standard costing – Material, Labour, Sales.
- vi. Budgets – meaning; benefits, types.

Module IV [8L]

- i. Management control system-nature, characteristics.
- ii. Understanding the concept of strategy, goals, key variables.
- iii. Responsibility centers, revenue centers, expense centers, profit centers-concepts.
- iv. Transfer pricing – concept and methods
- v. Organizational relationships in control - hierarchy, span of control.
- vi. Management Reporting System - need, essentials of an effective MR system, MBO.
- vii. Budgeting as a tool for managementcontrol

- viii. Management Control of: Service Organizations; Non-Profit Organizations; MNCs;Projects

Text Books:

1. Management: A Systems Approach - Koontz and O'Donnel, TMH.
2. Financial Accounting - PC Tulsian, Pearson Education.
3. Management Accounting - I.M. Pande, VIKAS.

Reference Books:

1. Management Techniques: A Practical Guide – John Argenti.
2. Management: A Global Perspective - Weihrich and Koontz, TMH.
3. Management Accounting - Khan & Jain, TMH.

Paper Name: ORAL AND WRITTEN COMMUNICATIONS					
Paper Code: HMTS1102					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.

Module I[10L]

Communication Skill : Definition, nature & attributes of Communication, Process of Communication, Models or Theories of Communication, Types of Communication, Levels or Channels of Communication, Barriers to Communication.

Module II [10L]

Business Communication: Scope & Importance, Writing Formal Business Letters, Writing Reports, Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular, Project Proposal, Technical Report Writing, Organizing e-mail messages, E-mail etiquette, Tips for e-mail effectiveness.

Module III [10L]

Language through Literature: Modes of literary and non-literary expressions, Excerpts from literary texts (prose, verse and drama), Using language for communication at various cultural and social settings, Descriptive, narrative and expository writing, Writing with a purpose, Writing essays/articles – logical organization of thoughts.

Module IV [10L]

Communication skills at Work: Communication and its role in the workplace, Benefits of effective communication in the workplace, Common obstacles to effective communication.

Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections.

Text Books:

1. Theories of Communication: A Short Introduction - Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan - Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Business English - Hauppauge, Geffner, Andrew P., New York: Barron's Educational Series.

Reference Books:

1. Writing and Speaking at Work: A Practical Guide for Business Communication - Edward P. Bailey, Prentice-Hall.
2. Business and Administrative Communication - Kitty O. Locker, McGraw-Hill/Irw
3. Intercultural Business Communication - Lillian Chaney and Jeanette Martin, Prentice Hall.

Paper Name: PROGRAMMING LAB					
Paper Code: MCAP1111					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	4	4	3

Software to be used: GNU C Compiler (GCC) with LINUX
NB: Cygwin (Windows based) may be used in place of LINUX

Course outcomes:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple textiles.

Problems related to the following topics:

- Topic 1: LINUX commands and LINUX based editors,
- Topic 2: Basic Problem Solving,
- Topic 3: Control Structures,
- Topic 4: Array (1-d, 2-d),
- Topic 5: Functions,
- Topic 6: Dynamic Memory Allocation,
- Topic 7: String Handling,
- Topic 8: Structure and Union,
- Topic 9: File Handling.

Paper Name: COMMUNICATIONS LAB					
Paper Code: HMTS1112					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	4	4	3

Course Outcomes:

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

Module I

Formal verbal communication:

- Introduction to formal verbal communication, Interpersonal Skills & Public Speaking: Building Positive Relationships, Focusing on Solving Problems, Time Management, Dealing with Criticism: Offering Constructive Criticism, Responding to Criticism – Managing Conflict: Approaches to Conflict, Resolving Conflict
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module II

Presentation skills:

- Speech Purposes - General: Informative Speeches, Persuasive Speeches, Entertaining Speeches, Methods of Speaking: Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organising the Presentation: the Message Statement, Organising the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium, Post-presentation Discussion

Module III

Group Discussion:

Introduction to Group Communication, Factors in Group Communication, Status – Group Decision Making: Reflective Thinking, Brainstorming, The Planning Process, Strategies for Successful GDs, Role of Social Awareness (Newspapers, Magazines, Journals, TV News, Social Media), Body Language, Logical Argument, Practice GDs

Module IV

Job Application and Personal Interview:

- Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of Well-Written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section
- Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination Chronological and Functional Resume – Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References
- Interviewing: Types of Interviews, Format for Interviews: One-to-one and Panel Interviews, Employment Interviews, Frequently Asked Questions, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews

Syllabus of 2nd semester:

Paper Name: COMPUTER ORGANIZATION AND ARCHITECTURE					
Paper Code: MCAP1201					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand Binary Number system, and logic design using basic logic gates and universal gates.
2. Able to design applications of Sequential Circuits.
3. Able to design Finite State Machines.
4. Understand the basic organization of computer and different instruction formats and addressing modes.
5. Analyze the concept of pipelining, vector-processing , segment registers and pindigram of CPU.
6. Understand and analyze various issues related to memory hierarchy and memory mapping technologies.
7. Understand various modes of data transfer between CPU and I/O devices.

Module I [10L]

Boolean Algebra & Logic Gates: Logic gates- truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, Kmap method.

Combinational Circuits: Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Multiplexer, De-Multiplexer and Parity Generator.

Module II [10L]

Sequential Circuits: Sequential Circuits - Basic memory element - S-R, J-K, D and T flip flops; Registers and counters and their design, Irregular counter, State table and state transition diagram; Sequential circuits design methodology.

Instruction Formats: Introduction to basic structures and operational concepts, Instruction formats, Instruction execution, sequencing, Addressing modes .

Module III [10L]

Control Unit: Concepts, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction, Hardwired control, Microprogrammed control.

Memory: Basic concepts, RAM, ROM – different types, Characteristics, Memory design (Linear addressing, interleaved memory) Cache memories, Performance (memory interleaving, hit rate etc.), Memory hierarchy - virtual memory – address translation, Secondary memories Data transfer through programmed I/O, interrupt and DMA, I/O processors.

Module IV[10L]

Input/output organization: Memory mapped, standard (isolated) and linear selection techniques of I/O addressing.

Pipelining: Arithmetic & instruction, speedup, vector processing, array processor, Introduction to RISC processor and parallel processing, Bit-Slice processors.

Text Books:

1. Digital Logic and Computer Design - M. Morris Mano, Pearson.
2. Computer System Architecture - Morris Mano, PHI.
3. Digital Logic Design – Mansaf Alam, Bashir Alam, PHI.

Reference Books:

1. Computer Organization – C. Hamacher, Z. Vranesik, S. Zaky, McGrawHill.
2. Computer Architecture and Organization – John P. Hayes, McGrawHill.
3. Digital Design: Basic Concepts and Principles - Mohammad A. Karim, CRC Press.

Paper Name: DATA STRUCTURES					
Paper Code: MCAP1202					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course outcomes:

1. Understand and remember the basics of data structures and Abstract data type (ADT).
2. Understand the significance and utility of different data structures and the context of their application.
3. Apply different types of data structures in algorithms and understand how the data structures can be useful in those algorithms.
4. Evaluate solutions of a problem with different data structures and thereby understand how to select suitable data structures for a solution. (For example, what are the different ways to find the second largest number from a list of integers and which solution is the best.)
5. Evaluate different types of solutions (e.g. sorting) to the same problem.

Module I[8L]

Introduction: Concepts: Datatype and data structure, Abstract Data Type. Classification, Algorithms concepts. Analysis: space and time analysis of algorithms – Big O, Θ , Ω notations.

Array: Different representations – row major, column major. Sparse matrix – its implementation and applications. Array representation of polynomials.

Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module II[8L]

Stack and Queue: Stack - implementation using array and linked list. Applications. Queue, circular queue, deque - implementation using array and linked list. Applications.

Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi.

Module III[12L]

Graphs: Graph representations / storage – using adjacency matrix, adjacency list.

Trees: Basic Terminologies, tree representation – using array and linked list. Binary trees: traversal (pre-, in-, post-, level- order). Threaded binary trees. Huffman trees. Heaps – implementation of priority queue. Binary Search trees, AVL tree (insertion, deletion with examples only), B-tree (insertion, deletion with examples only), Trie (insertion, deletion with examples only).

Module IV[12L]

Searching: Sequential, Binary. Complexity analysis and comparison.

Sorting: Introduction – idea about internal and external sorting, in-place sorting, stability, adaptivity. Sorting algorithms - Bubble, Insertion, Selection, Shell, Quick, Merge, Heap, Radix. Complexity analysis (Average case analysis not required), and comparison.

Hashing: Hash Functions. Collision resolution – open and closed hashing.

Text Books:

1. Classic Data Structures - Debasis Samanta, PHI Learning.
2. Data Structures and Program Design in C - Robert L Kruse, Bruce P. Leung, Pearson Education.
3. Data Structures using C - Aaron M Tenenbaum, Moshe J Augustein, Pearson Education.

Reference Books:

1. Data Structures -Seymour Lipshutz, McGrawHill.
2. Fundamentals of Data Structures in C -Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, UniversitiesPress.

Paper Name: DATABASE MANAGEMENT SYSTEMS I					
Paper Code: MCAP1203					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand and describe data models and schemas in DBMS.
2. Understand the features of database management systems and Relational database.
3. Apply relational algebra and calculus to interpret data in relational format.
4. Apply SQL the standard language of relational databases.
5. Analyze the functional dependencies and design of the database.
6. Understand the concept of storage for various forms of data.
7. Develop the concept of different levels of indexing to optimize query processing.

Module I[10L]

Introduction to DBMS: Basic Concepts of Operational Data, Data vs Information, Introduction to Database and DBMS, Importance of Database Design, Files and File Systems, Problems with File System Data Management, Database Systems, Views of Data, Three-Level Architecture, Instances and Schemas, Database Administrator, Database Users, Advantages and Disadvantages of DBMS.

Data Model: Data Modeling and Data Models, Importance of Data Models, Data Model Basic Building Blocks, The Evolution of Data Models, Degree of Data Abstraction.

Entity-Relationship Modeling: Entity and Entity Instances, Attributes, Entity Relationships, Cardinality of Relationships, Strong and Weak Entity, Generalization, Specialization, Aggregation, Developing an ER Diagram, Entity Integrity and Primary Key, Translating ER Model into Relational Model.

Module II[10L]

Relational Model: A Logical View of Data, Keys, Integrity Rules, Relational Set Operators, Data Dictionary and the System Catalog, Relationships within the Relational Database, Data Redundancy Revisited, Indexes, Codd's Relational Database Rules.

Relational Database Design: Functional Dependency (FD) –Definition, Trivial and Non-Trivial FD, Closure of Set of FD, Closure Of Attribute Sets, Irreducible Set of FD, Canonical Cover, Normalization – 1NF, 2NF, 3NF,BCNF, Decomposition using FD, Lossless Decomposition, Dependency Preservation.

Module III[10L]

Relational Algebra: Select Operation, Project Operation, Join Operation, Division Operation, Cross Product Operation, Set operations.

Relational Calculus: Introduction, Tuple Relational Calculus, Operators used in TRC, Example queries using TRC, Domain Relational Calculus, Operators used in DRC, Example

queries using DRC, Comparison of TRC, DRC, RA.

Structured Query Language (SQL): Introduction to SQL, DDL, DML, DCL, Basic Structure, Basic Queries, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, Assertions, Views, Joining Database Tables, Commit, Rollback.

Module IV[10L]

Advanced SQL: Subqueries and Correlated Queries, SQL Built in Functions - Numeric, Date, String Functions, Updatable Views.

Storage structure: Sequential and indexed file organization, B+ tree - creation, insertion & deletion.

Indexing: Primary, Secondary & Multi Level.

Text Books:

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH.
2. Fundamentals of Database Systems - Elmsari and Navathe, Addison-Wesley.

Reference Books:

1. An Introduction to Database Systems - Date C. J, Addison-Wesley.
2. SQL-PL/SQL - Ivan Bayross, BPB.

Paper Name: INFORMATION SYSTEM ANALYSIS DESIGN AND IMPLEMENTATION					
Paper Code: MCAP1204					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand the idea of information system in lieu of the modern abstraction of data.
2. Analyze various phases of system development lifecycle.
3. Gather data to analyse and specify the requirements of system.
4. Design system components and environments.
5. Analyze the feasibility of project.
6. Deliver various types of system documentation.

Module I [10L]

Data and Information: Types of information: operational, tactical, strategic and statutory. Why do we need information systems? Requirement of information at different levels of management, Requirement of information for various functions. Quality of information.

Systems Analysis and Design Life Cycle: System definition and concepts, system environments and boundaries. Real time and distributed systems, basic principles of successful systems. Role and attributes of a systems analyst. Requirements determination, requirements specifications, feasibility analysis, final specifications, hardware and software study, system design, system implementation, system evaluation, system modification.

Module II [10L]

Information gathering: Strategies and methods. System requirements specification.

Feasibility analysis: Deciding project goals, examining alternative solutions, cost–benefit analysis, quantifications of costs and benefits, payback period, system proposal preparation for managements, parts and documentation of a proposal, tools for prototype creation.

Data flow diagrams: Rules and conventions, levels of DFDs, logical and physical DFDs. Software tools to create DFDs.

Module III [10L]

Structured systems analysis and design: Procedure specifications in structured english, decision tables for complex logical specifications, Specification oriented design vs. Procedure oriented design.

Data oriented systems design: Entity relationship model, E-R diagrams, relationships, cardinality and participation, normalizing relations and their use.

Coding practices: Coding techniques, requirements of coding schemes, error detection of codes.

Data input methods: Input Design, validating input data, input data controls, interactive data

input.

Designing outputs: Designing output reports- screen design, graphical user interfaces, interactive I/O on terminals.

Form design: Classification of forms, requirements of form design, Types of forms, Layout considerations, Form control.

Module IV [10L]

System control: Need for controls, objectives of controls, techniques used in controls, Gantt chart, PERT.

System implementation and maintenance: Planning considerations. Conversion methods, procedures and controls. System acceptance criteria. System Evaluation and Performance. Testing and Validation. Preparing User Manual. Maintenance Activities and Issues.

System audit and security: Audit of Computer System Usage. Types of Threats to Computer System and Control Measures, Threat and Risk Analysis, Disaster Recovery and Contingency Planning, Viruses.

Text Books:

1. Software Engineering: A Practitioner's Approach - Roger. S. Pressman, 7th Edition, Tata McGraw Hill.
2. Systems Analysis and Design - Kendall, Kenneth E and Julie E. Kendall, 7th Edition, Prentice Hall of India.
3. Systems Analysis & Design - Alan Dennis, Barbara H. Wixom and Roberta M Roth, 4th Edition, Wiley & Sons.

Reference Books:

1. System and Design Methods - Jeffrey, L. Whitten and Lonnie D. Bentley, 6th Edition, Tata McGraw Hill
2. Modern Systems Analysis and Design - Jeffrey A. Hooper, Joey F. George and Joseph S. Valacich, 5th Edition, Pearson Education.
3. Systems Analysis and Design Techniques, Methodologies, Approaches, and Architectures - Roger H.L.Chinan, Keng Siau, and Bill C. Hardgrave, 1st Edition, Prentice Hall of India.

Paper Name: PROBABILITY AND STATISTICAL COMPUTING					
Paper Code: MCAP1205					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Demonstrate the knowledge of probabilistic approaches to solve wide range of problems.
2. Recognize probability distribution for discrete and continuous variables to quantify physical phenomenon.
3. Appreciate the importance of probability and statistics in computing and research.
4. Understand basic statistical inference techniques for drawing inferences on real life data.
5. Use appropriate statistical methods in the analysis of simple datasets.
6. Interpret and clearly present output from statistical analyses in a clear concise and understandable manner.

Module I[10L]

Probability: Random Experiment, Sample Space, Random Events, Probability of Events, Probability of Non-Disjoint Events (Theorems), Counting Techniques Applied to Probability Problems. Conditional Probability, Stochastic Independence of Events, Bayes' Theorem and Related Problems.

Module II[10L]

Random Variable and Probability Distribution: Concept of Random Variables, Probability Mass Function, Probability Density Function and Distribution Function. Expectation and Variance, Moment Generating Function, Chebyshev's Inequality (statement) and Related Problems. Binomial, Poisson, and Normal Distributions.

Module III[10L]

Sampling and Estimation: Sampling: Population, Sample, Random Sampling, Statistic and its Distribution, Standard Error of Statistic, Sampling Distribution of Sample Mean and Variance in Random Sampling from a Normal Distribution (statement only) and Related Problems.

Estimation of Parameters: Point Estimation, Unbiased, Minimum Variance Unbiased and Consistent Estimators, Interval Estimation, Maximum Likelihood Estimation and Related Problems.

Module IV[10L]

Testing of Hypothesis: Simple and Composite Hypothesis, Critical Region, Level of Significance, Type I and Type II Errors, Power of a Test, Unbiased Tests, Neyman-Pearson Theorem (proof not required), Application to Normal Population, Likelihood Ratio Test (proof not required), Comparison of Binomial and Normal Populations, Testing of Equality of Means χ^2 - Test for Goodness of Fit.

Text Books:

1. A First Course in Probability - S. Ross, Collier Macmillan.
2. Statistical Methods (Volume 1 and 2) – N. G. Das, TMH.

Reference Books:

1. Mathematical Statistics – S.C. Gupta and V. K. Kapoor, S. Chand.
2. Engineering Mathematics: Volume IIIA – B. K. Pal & K. Das, U. N. Dhur & Sons Pvt. Ltd.
3. Introduction to Mathematical Statistics - Hogg, McKean and Craig, American Publishing.
4. Statistical Analysis: A Computer Oriented Approach - A. A. Afifi, Academic Press.

Paper Name: DIGITAL LOGIC AND COMPUTER ARCHITECTURE LAB					
Paper Code: MCAP1211					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	4	4	3

Course Outcomes:

1. Use the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method etc.
2. Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
3. Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
4. Realize different logic circuits using ICs built with various logic families.

Problems related to the following topics:

Topic 1: Realization of AND, OR, NOT, NAND, XOR gates using respective chips. Design AND, OR gates using basic design elements (Diod, Resistance, Transistor etc.),

Topic 2: Implementation of AND, OR, NOT, XOR gates using NAND Gate as a Universal Gate. Realize the following equation using only minimum number of NAND gates

$$Y = B'C' + A'BC,$$

Topic 3: Design Half Adder & Full Adder Circuits using basic Gates,

Topic 4: Design Half Subtractor & Full Subtractor Circuits using basic Gates,

Topic 5: Design Adder-Subtractor Composite circuit,

Topic 6: Design and implementation of 16 bit odd/even parity checker / generator using IC74180,

Topic 7: Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147,

Topic 8: Realization of 4:1 & 2:1 MUX Chips. Implement a 8:1 MUX using 4:1 MUXs,

Topic 9: Design S-R, D, J-K Flipflop,

Topic 10: Design and implementation of 3-bit synchronous up/down counter,

Topic 11: Horizontal expansion of RAM,

Topic 12: Vertical expansion of RAM.

Paper Name: DATA STRUCTURES LAB					
Paper Code: MCAP1212					
Contact hrs. per week	L	T	P	Total	Credit Points
	0	0	4	4	3

Course Outcomes:

1. To understand linear and non-linear data structures.
2. To understand different types of sorting and searching techniques.
3. To know how to create an application specific data structures.
4. To solve the faults / errors that may appear due to wrong choice of data structure.
5. To analyze reliability of different data structures in solving different problems.

Problems related to the following topics:

Topic 1: 1-D and 2-D array,

Topic 2: Linked List (Singly linked list, Circular Linked List, Doubly Linked List),

Topic 3: Stack and Queue implementation using array and linked list,

Topic 4: Implementation of different recursive algorithms,

Topic 5: Implementation of Binary Search Tree (insertion, deletion, searching, traversals),

Topic 6: Different searching and sorting algorithms.

Paper Name : DBMS I LAB					
Paper Code: MCAP1213					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	4	4	3

Course Outcomes:

1. Apply the RDMS concepts to create various schema and instances in terms tables.
2. Populate the relation of tables with proper restriction through keys.
3. Retrieve specific data from table/s through subquery.
4. Filter data from joining various tables.
5. Use proper data control language to restrict the accessibility of data.

Problems related to the following topics:

Topic 1: Database Creation

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

Topic 2: Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

Topic 3: Retrieving Data from a Database

- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Topic 4: Clause

- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

Topic 5: Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

MCA 3rd Semester

Paper Name: OBJECT ORIENTED PROGRAMMING WITH JAVA					
Paper Code: MCAP2101					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the OOPs concepts.
2. Solve real world problems using OOP techniques.
3. Understand the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
4. Understand the use of packages and interface.
5. Develop and understand exception handling, multithreaded applications with synchronization.
6. Understand the use of collection framework

Module I - [10L]

Introduction to Object Oriented Programming

Genesis of Object Oriented Programming. Problems with Procedural Programming, Object Oriented Concepts – Objects & Classes, Abstraction, Encapsulation, Message Passing, Access Specifier, Relationships, Aggregation, Links & Associations, Generalization & Specialization, Inheritance, Abstract Classes, Meta-Class, Grouping Constructs. Comparison of Procedural & OOP.

Introduction to Java

Introduction and Overview, Virtual machines - concept and hierarchy of virtual machines. Basic Language Constructs, Arrays. String Class, String Methods, String Arrays, Command Line Arguments, StringBuffer Class, StringBuffer Methods.

Module II - [10L]

Classes and Objects

Defining a Class, Creating Objects, Assigning Object Reference Variables, Introducing Methods, Array of Objects, Constructors, Method Overloading, Passing and Returning Objects, “this” Keyword, Static Members, Introducing Access Control, Inner and Nested Classes.

Inheritance

Inheritance and Code Reusability, Types of Inheritance, Dealing with “super”, Multilevel Inheritance, Method Overriding, “final” Keyword, Object Class, Abstract Classes.

Module III - [10L]

Interface

Defining Interfaces, Implementing Interfaces, Extending Interfaces, Interfaces and Multiple Inheritance.

Package

Using Packages, Java API, User Defined Packages, Classpath, Access Control.

Exception Handling

Exception and Exception Handling, Exception Types, Built-in Exceptions, “throw”, “throws”, “finally”, Creating User Defined Exceptions, Chained and Unchained Exceptions.

Module IV - [10L]

Multithreading

Multitasking & Multithreading, Java and Multithreading, Creating Threads, Life Cycle of a Thread, Thread Methods, Thread Priorities, Synchronization and Deadlock.

Event Handling :

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class etc.

Excerpts from java.util and java.lang

Garbage Collection, String Tokenizer, Collections API.

Text Books:

1. JAVA: The Complete Reference – Herbert Schildt, TMH.
2. Core Java I and II – Horstmann and Cornell, Oracle Corporation.

Reference Books:

1. Object Oriented Modeling & Design, James R. Rum Baugh, PHI.
2. The Java Programming Language – James Gosling, Addison Wesley.
3. Java – How to Program – Deitel and Deitel, PHI.
4. A Programmer’s Guide to Java SCJP Certification - Khalid A. Mughal and Rolf W. Rasmussen, Addison Wesley.

Paper Name: DATABASE MANAGEMENT SYSTEMS II					
Paper Code: MCAP2102					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Improve the database design using higher normal form.
2. Understand the concept of a database transaction, its properties and how database transactions are managed.
3. Learn concurrency control and its role in maintaining the database's integrity.
4. Knowledge about data object locking and protocols.
5. Understand database recovery management and its use to maintain database integrity.
6. Knowledge about RDBMS architecture
7. Perform PL/SQL programming using concept of cursor management, error handling, package and triggers.
8. Execute various advance SQL queries related to transaction processing &locking using concept of concurrency control.
9. Non-relational database(e.g. NoSQL, MongoDB).

Module I [10L]

Higher Normal Forms

Overview of Lossless Join Decomposition and Dependency Preservation, Multi-valued Dependency and 4NF, Project-Join Decomposition and 5NF, domain-key and DKNF.

Transaction Processing

Transaction Concept and State, Implementation of Atomicity and Durability.

Concurrency Control

Executions, Serializability, Recoverability, Implementation of Isolation.

Concurrency Control Techniques: Lock based Protocols, Timestamp based Protocols, Validation based Protocols.

Multiple Granularity, Multiversion Schemes, Deadlock Handling.

Module II [10L]

Recovery Management

Failure Classification, Storage Structure, Recovery and Atomicity, Log-based Recovery, Shadow Paging, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques.

Case Study: RDBMS Architecture

Memory Structures, background processes, disk utilization structures, Starting and stopping the database instance, Creating a Database.

Module III [10L]

Introduction to Procedural Language/Structured Query Language (PL/SQL)

PL/SQL block structure, Variables, Control Structure and iteration, Implicit and Explicit Cursors, Stored procedures and functions, PL/SQL packages, Triggers, Locks.

Module IV [10L]

Introduction to Distributed Database Management System

Distributed DBMS Architecture, Distributed Query Processing, Distributed Concurrency Control.

NoSQL

Introduction, importance, history, RDBMS vs NoSQL, CAP Theorem (Brewer's Theorem), The BASE, ACID vs BASE, advantages and disadvantages of NoSQL. NoSQL Categories - Key-value stores, Column-oriented, Graph, Document oriented.

Introduction to MongoDB

Features, Databases, Schemas, and Tables, MongoDB and ACID transactions, MongoDB and caching, Introduction to mongo Shell, Data Types, Databases, Documents, Collections , MongoDB Connections, Query and Projection Operators, Update Operators , Aggregation Pipeline Operators, MongoDB count() cursor method, Database Commands, MongoDB -, INSERT, UPDATE, DELETE, INDEX

Text Books:

1. Database System Concepts – A.Silberschatz, Henry F. Korth, S. Sudarshan, TMH.
2. An Introduction to Database Systems - C.J. Date, Pearson.

Reference Books:

1. Fundamentals of Database Systems–RamezElmasri, Shamkant B. Navathe, Pearson.
2. Database Systems: The Complete Book - Jeffrey D. Ullman, Jennifer Widom, PHI.
3. Distributed Databases Principles and Systems - Ceri, Pelagatti, TMH.
4. NoSQL for Mere Mortals - Dan Sullivan, Pearson
5. MongoDB: The Definitive Guide - Kristina Chodorow, O'Reilly.

Paper Name: OPERATING SYSTEMS					
Paper Code: MCAP2103					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Analyze the structure of OS and basic architectural components involved in OS design.
2. Analyze and design the applications to run in parallel either using process or thread models of different OS
3. Analyze the various device and resource management techniques for timesharing and distributed systems
4. Understand the Mutual exclusion, Deadlock detection and agreement protocols of distributed operating system
5. Interpret the mechanisms adopted for file sharing in distributed Applications
6. Conceptualize the components involved in designing a contemporary OS

Module I [8L]

Introduction

Introduction to Operating Systems, Concept of batch-processing, single and multi-programming, single and multi-processing, multi-tasking, real time, distributed and parallel processing.

Process and Scheduling

Concept of process, state diagram, process control block, Scheduling-short, medium and long term scheduling.

CPU Scheduling criteria, types of scheduling, non-preemptive and preemptive scheduling algorithms like: First Come First Serve (FCFS), Shortest Job First/Next (SJF/N), Shortest Remaining Time Next (SRTN), Round Robin (RR), Highest Response Ratio Next (HRRN), Priority based scheduling, Multilevel queue scheduling, Multilevel feedback queue scheduling.

Threads

Concept, process vs thread, kernel and user threads, multi-threading models.

Module II [12L]

Inter-process Communication

Shared memory approach, message passing, FIFO, concept of semaphore, critical region, monitor.

Process Synchronization

Concepts, race condition, mutual exclusion, critical section problem and its solutions; synchronization tools - semaphore, semaphore with queue, monitor; discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber.

Module III [10L]

Deadlock

Characterization, Prevention, avoidance, detection, recovery.

Memory Management

Address space and address translation; memory partitioning - static and dynamic, different types of fragmentation, swapping, paging, segmentation, virtual memory concepts, demand paging, performance, page replacement algorithms FIFO, LRU, Optimal page replacement, variants of LRU; frame allocation, thrashing, working set strategy.

Module IV[10L]

Disk Management

Disk structure, disk scheduling algorithms - FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK; disk formatting, boot block, badblocks.

File Systems

File and operations on it, file organization and access; file allocation; directory structures, file allocation methods contiguous, linked, indexed; free space management bit vector, linked list, grouping.

I/O Management

I/O hardware, polling, interrupts, DMA, application I/O interface block and character devices, network devices, clocks and timers, blocking and non-blocking I/O; kernel I/O subsystem scheduling, buffering, caching, spooling, error handling.

Protection and Security

Concepts of domain, Access matrix and its implementation, access control. Security concepts, program threats, system threats, threat monitoring, cryptography as security tool, user authentication.

Text Books:

1. Operating System Concepts - Silberschatz, Galvin, Gagne, Wiley.
2. Operating Systems Design and Implementation - Andrew S. Tanenbaum, Prentice Hall.

Reference Books:

1. Operating Systems -Dietel, Dietel, Choffnes, Prentice Hall.
2. Operating Systems Internals and Design Principles - Stallings, Pearson.

Paper Name: DESIGN AND ANALYSIS OF ALGORITHMS					
Paper Code: MCAP2104					
Contact hrs per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Analyze the correctness of algorithms using mathematical induction and invariants.
2. Evaluate the asymptotic complexity and running times of algorithms.
3. Categorize between different paradigms of algorithm design Viz. Divide and Conquer, Greedy, Dynamic Programming, Backtracking and Branch-and-Bound.
4. Understand the algorithmic approximation scheme for hard problems.
5. Apply various mathematical principles to solve a problem.
6. Create or design an algorithm for a real time problem.

Module – I [10L]

Introduction

Algorithm specification, performance analysis - time and space complexity, asymptotic notations, Master theorem, Correctness of algorithms.

Divide and Conquer

General method, binary search, quick sort, merge sort, performance analysis; Strassen’s matrix multiplication.

Lower Bound Theory

Comparison tree, lower bound on comparison-based sorting, sorting in linear time, counting sort.

Module – II [12L]

The Greedy Method

General method, fractional knapsack problem, job sequencing with deadlines, minimum cost spanning trees – Prim’s and Kruskal’s algorithms.

Dynamic Programming

General method, Shortest path algorithms – Bellman Ford, Floyd Warshall, 0/1 Knapsack Problem, Traveling Salesman Problem.

Module – III [8L]

Traversal and Search Techniques

Breadth First (Search and Traversal), Depth First (Search and Traversal), Bidirectional Search.

Pattern Matching

Brute-Force Algorithm, Knuth-Morris-Pratt Algorithm.

Backtracking

General Method, 8 Queens Problem, Knight's Tour, Graph Colouring.

Module – IV[10L]

Branch and Bound

General Method, Least Cost Search, 15 Puzzles Problem.

Introduction to NP-completeness

Basic concepts, P – NP - NP Hard and NP Complete classes, Relative hardness of problems and Polynomial time reductions. Circuit Satisfiability problem, Clique Decision Problem, Vertex Cover Problem.

Approximation Algorithms

Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, approximation algorithms for vertex cover, travelling salesman problem.

Text Books:

1. Introduction to Algorithms - Cormen et al, PHI Learning
2. Fundamentals of Computer Algorithms - Horowitz, Sahni, Orient Longman

Reference Books:

1. The Design and Analysis of Computer Algorithms - Aho, Hopcroft, Ullman, Pearson
2. Algorithm Design - Kleinberg, Tardos, Pearson
3. The Art of Computer Programming - Knuth, Pearson

Paper Name: OPTIMIZATION TECHNIQUES					
Paper Code: MCAP2105					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
2. Explain the relationship between a linear program and its dual, including strong duality and complementary slackness
3. Develop mathematical skills to analyze and solve integer programming
4. Develop and promote research interest by applying Transportation, Assignment and Travelling salesman problem in real life situations.
5. Demonstrate solution methods including graphs and linear programming to analyze and solve the Two-person, zero-sum games.
6. Understand the role and application of PERT/CPM for project scheduling and management with expected activity time estimation.
7. Understand different queuing situations and find the optimal solutions using models for different situations.
8. Develop the idea of job sequencing to minimize the production time and costs, also to help production facility for staff allocation and equipment management.

Module I [10L]

Introduction

The nature of Optimization Techniques, History, Meaning, Models, Principles Problem solving with mathematical models, optimization process.

Linear Programming

Basic LPP and applications, various components of LP problem formulation, Graphical Method, Simplex Method, Big-M method, Duality in linear programming.

Integer programming

Concepts, Formulation, Solution and Applications (Branch & Bound method).

Module II [10L]

Transportation Problem

Formulation, Initial solution - North-West corner method, Least cost method, Vogel's approximation method (VAM). Optimal solution –Economic interpretation of u_i 's and v_j 's, MODI method, Properties of closed-loop. Unbalanced transportation problems, Degeneracy and its resolution, Alternate optimal solution, Prohibited transportation route. Maximization transportation problems.

Assignment Problem

Formulation, Optimal solution - Hungarian method. Multiple optimal solution, Maximization problem, Unbalanced assignment problem, Restriction on assignment problem. Travelling salesman problem.

Module III [10L]**Game theory**

Introduction, Decision making under risk, Decision making under uncertainty. Two person Zero Sum game (Pure Strategy and Mixed Strategy), Properties of a game, Maximin and Minimax principles, Method of solving game - Saddle point, Principle of dominance, Algebraic method, Graphical method, Linear Programming method.

Network Optimizations

PERT/ CPM – Introduction, Significance of use, Network components and precedence relationship (AOA and AON diagram), Critical path analysis- Forward pass, Backward pass, Float(slack) of Activity and Event.

Module IV [10L]**Queuing Theory**

Introduction, Basic definitions and notations, Structure of a Queuing system, Axiomatic derivation of the arrival & departure distributions for Poisson Queue, M/M/1 Queuing Model.

Sequencing Model

Introduction, Notation, Terminology and Assumption. Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of n jobs through m machines, Processing of two jobs through m machines.

Text Books:

1. Operations Research: Theory and Applications - J K Sharma, MacMillan.
2. Operation Research – Kanti Swarup, Gupta P K, Man Mohan, Sultan Chand & Sons.

Reference Books:

1. Operations Research: An Introduction - H. Taha, Prentice Hall.
2. Operations Research - Hillier & Lieberman, TMH.

Paper Name: OBJECT ORIENTED PROGRAMMING LAB					
Paper Code: MCAP2111					
Contact hrs per week:	L	T	P	Total	Credit Point
	0	0	4	4	3

Course Outcomes:

1. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
2. Be able to use the Java SDK environment to create, debug and run simple Java programs.
3. Implement classical problems using java programming.
4. Implement problems related to inheritance, polymorphism, interfaces, packages, multithreading and collections framework.
5. Build software development skills using java programming for real world applications.
6. Implement backend of an application.

Programs related to:

- Language Features
- Arrays in Java and String Handling
- Classes and Objects
- Inheritance
- Interface and Package
- Exception Handling
- Multithreading
- Event Handling
- java.util and java.lang

Paper Name: DBMS II LAB					
Paper Code: MCAP2112					
Contact hrs per week:	L	T	P	Total	Credit Point
	0	0	4	4	3

Course Outcomes:

1. Gather knowledge about the PL/SQL structure.
2. Familiarize with PL/SQL programming including stored procedures, stored functions.
3. Able to create triggers, cursors, packages using PL/SQL.
4. Able to execute various advance SQL queries related to Transaction Processing.
5. Understand the techniques relating to concurrency in multi-user database environments by applying different type of LOCK.
6. Understand to handle database objects using NoSQL.
7. Perform data manipulation and create Indexes using NoSQL.

Problems on -

- PL/SQL overview
 - Structure of PL/SQL block.
 - Using PL/SQL variables, taking user input and displaying the output.
 - PL/SQL Control structures(Conditional control, Iterative control, Sequential control)
 - Built-in PL/SQL functions
 - PL/SQL composite datatype (Tables, ROWTYPE)
 - Subprograms
 - Procedures
 - Functions
 - Cursor Management
 - Implicit Cursor
 - Explicit Cursor
 - Cursor for-loop
 - Database Triggers
 - Error Handling
 - Packages
- Transaction management
 - Transaction with COMMIT, ROLLBACK, SAVEPOINT
 - Locking with pair of user
 - Locking with multiuser
- NoSQL
 - Creation of a database objects with constraints. Deletion and modification of database objects.
 - Performing Insertion, Deletion, and Updation of documents.
 - Creation of Indexes

MCA 4th Semester

Paper Name: COMPUTER COMMUNICATION NETWORKS					
Paper Code: MCAP2201					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Learn different aspects of data communication networks, hardware, software and components of a network and their interrelations.
2. Understand the purpose of layered architecture and different protocols.
3. Understand the different LAN protocols and selection of appropriate protocols.
4. Analyze the performance of the different routing protocols.
5. Understand the concept of internetworking, congestion control mechanisms.
6. Learn about quality of service issues.

Module I – Data Communication Fundamentals and Physical Layer [10L]

Overview of Data Communication & Networking

Introduction: Data Communication Systems, Networks, Protocols & Standards, the Internet Layered Tasks: Utility of Layering, ISO/OSI Reference Model, TCP/IP Reference Model, Comparison between OSI and TCP/IP

Connecting Devices: Repeater, Hub, Bridge, Switch, Router, Gateway

Switching: Overview of – Circuit Switching, Message Switching, Packet Switching, Virtual Circuit Switching

Physical Layer

Signals: Data & Signals, Data Rate Limits, Transmission Impairments

Digital Transmission: Line Coding, Sampling, Transmission Mode

Analog Transmission: Modulation of Digital Data, Modulation of Analog Signals

Multiplexing: FDM, TDM, WDM

Transmission Media: Guided Media, Unguided Media

Module II – Data Link Layer and MAC Sublayer [10L]

Data Link Layer

Framing: Character Stuffing, Bit Stuffing

Error Detection & Correction: Types of Error – Single Bit Error, Error Detection, Error Correction

Flow Control: Stop – And – Wait ARQ, Sliding Window Protocols

Data Link Layer Protocols: HDLC, PPP

Medium Access Sub layer

Random Access: ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA

Controlled Access: Reservation, Polling, Token Passing

LAN: Ethernet (Traditional, Fast and Gigabit), FDDI, DQDB

Module III – Network and Transport Layer [10L]

Network Layer Internetworking, Addressing and Routing: Internetworking, Addressing (Internet Address, Classful Addressing, Subnetting), Routing (Static and Dynamic Routing, Distance Vector Routing, Link State Routing)

Network Layer Protocols: ARP, RARP, IP, ICMP and IGMP, IPv6

Network Monitoring and Management: Concepts of Wireshark and SNMP

Module IV – Application Layer and Miscellaneous Topics [10L]

Transport Layer Process-to-Process Delivery, UDP, TCP: Process to Process Delivery, User Datagram Protocol and Transmission Control Protocol

Congestion Control & Quality of Service: Data Traffic, Congestion and Congestion Control, Quality of Service (QoS), Techniques to improve QoS – Leaky Bucket and Token Bucket Algorithms

Application Layer Application layer protocols: DNS, Telnet, FTP, SMTP, HTTP, WWW

Text Books:

1. Data Communications & Networking – B.A. Forouzan, TMH.
2. Computer Networks - Andrew S. Tanenbaum, Pearson Education.
3. Data and Computer Communication - William Stallings, PHI.

Reference Books:

1. High speed Networks and Internets - William Stallings, Pearson Education.
2. Cryptography and Network Security - William Stallings, PHI.
3. Computer Networking: A Top Down Approach - Kurose & Ross, Pearson Education.

Paper Name: WEB TECHNOLOGY					
Paper Code: MCAP2202					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the concept of Web Technologies.
2. Combine the ideas of HTML,CSS, and Java Script to build Web pages.
3. Analyze the use of XML in Advanced Web Technologies.
4. Prepare a well formed /valid XML document, schema to store and transfer data.
5. Recognize and understand the importance of Client Side Scripting Language with Java Scripts.
6. Create interactive web pages by Using PHP.
7. Able to write a server side programming using PHP with MySQL to store the data sent from client, process it and store it on database.

Module I [10L]

Introduction

A brief history of the Internet, current trends and emerging technologies, internet protocols and applications, Concept of WWW; Features, typical design elements, applications, opportunities and challenges of Web 1.0, Web 2.0. Main features of Web 3.0, opportunities and challenges in its implementation.

Web Browsers & Servers

Functionality of a browser, main components. Web Servers: Analysis of the components of servers from both a hardware and software perspective with introduction to LAMP software and alternative solutions.

Web Design& Development

Techniques useful in the design of web projects including site maps, wireframes, storyboarding. Introduction to development models and best practices. Development tools – frameworks, templates. Examples of IDEs for web development.

HTML

Markup languages, page layout, text layout, navigation, graphics, tables, forms, canvas.

Module II [10L]

Cascading Style sheets

Need for CSS, basic syntax and structure, layout formatting, font and text decoration, responsive styling.

Extensible Markup Language (XML)

XML basics, elements and attributes, namespace, validation, DTD, schema, parsing, XPATH search, XSLT transformation.

Module III [10L]

HTTP

Message, request, response, methods, status codes.

Client side scripting with JavaScript

Basic syntax, variables, operators, conditionals and loops, functions, events and error handling, timer, properties and methods of DOM, arrays; working with numbers, date and string; form validation.

Module IV [10L]

Server side scripting with PHP

Basic syntax of PHP, decision and looping, arrays, functions, browser control and detection, string processing and regular expressions, form processing, files, cookies and sessions.

PHP & MySQL

Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, updating and deleting data and tables, PHP myadmin and database bugs.

Text Books:

1. Web Technologies – Uttam Roy, Oxford.
2. Learning PHP, MySQL & JavaScript: With JQuery, CSS & HTML5 – Robin Nixon, Shroff Publishers.

Reference Books:

1. HTML & CSS: Design and Build Web Sites - Jon Duckett, John Wiley & Sons.
2. PHP 6 and MySQL 5 for Dynamic Web Sites - Larry Ullman, Peachpit Press.
3. Web Technologies (Black Book) -Kogent Learning Solutions Inc, Dreamtech Press.
4. Internet Technology & Web Design – Satish Jain, BPB Publications

Paper Name: ARTIFICIAL INTELLIGENCE AND APPLICATIONS					
Paper Code: MCAP2203					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Establish the historical perspective of human endeavor to know about the nature of intelligence and the related mathematical models.
2. Understand the role of intelligent agents to solve various real time problems.
3. Understand different forms of learning models.
4. Apply the principles of AI in finding the solutions that require problem solving with single agent and multi agents, inference, perception, knowledge representation, and learning.
5. Understand knowledge representation using mathematical logic.
6. Analyze the working principle of an expert system.
7. Analyze the paradigms of planning through AI language like prolog or lisp.
8. Understand structured knowledge representation using semantic nets, frame and scripts.
9. Analyze uncertainty using non-monotonic reasoning, probabilistic reasoning, and use of certainty factors.
10. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Module I – [10L]

Introduction

Introduction to AI - definition of AI, typical AI problems, practical impact of AI, approaches to AI, limits of AI today, AI history.

Intelligent Agents

Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, agent environment.

Problem Solving using Search -(Single agent)

State space search, explicit & implicit state space; Uninformed Search- search strategies, search tree, Breadth First Search, Uniform-cost search, Depth First Search; Informed search strategies – introduction, Hill Climbing search, Best First Search, Simulated Annealing, Genetic Algorithm Search, A* Search.

Module II – [10L]

Problem Solving using Search-(Multi agents)

Adversarial Search- and-or graph, AO* search, two agent games – minmax & game trees, refining minmax, Alpha-Beta pruning.

Constraint satisfaction problems (CSP)

Representation of CSP, solution of CSP, variable and value ordering, heuristic search in CSP.

Knowledge Representation and Logic (Propositional Logic)

Knowledge representation and reasoning, inference, rules of inference, using inference rules to prove a Query/Goal/Theorem, soundness and completeness.

Module III – [10L]

Knowledge Representation and Logic (First Order Logic)

First Order Logic, unification, semantics, soundness, completeness, consistency, satisfiability; Inference in First Order Logic – resolution, proof as search, proof strategies, non-monotonic reasoning.

Knowledge Representation and Logic (Rule based Systems)

Rule Based Systems, Horn Clause Logic, Backward Chaining, Forward chaining, expert systems.

Other Representation Formalisms

Knowledge representation formalisms, semantic networks, inference in semantic networks; frame, inference in frame; script, inference in script.

Module IV – [10L]

Planning

Introduction to planning, logic based planning, planning systems - representation of states and goals, representation of action; Planning algorithm - planning as search, Partial-Order planning, Plan-Space planning algorithms.

Reasoning with Uncertainty (Probabilistic reasoning)

Reasoning with uncertain information- Probabilistic reasoning, review of probability theory; Probabilistic inference rules; Bayesian Networks - semantics of Bayesian networks, learning of Bayesian Network parameters, inferencing in Bayesian Networks, approximate inferencing in Bayesian Networks.

Reasoning with Uncertainty (Fuzzy Reasoning)

Reasoning with uncertainty, the problem: Real-World Vagueness, Historic Fuzziness; Fuzzy Sets: Basic Concepts, operations on Fuzzy sets; Fuzzy reasoning - Fuzzy inferencing; applications.

Text Books:

1. Artificial Intelligence - A Modern Approach, S. Russell and P. Norvig, Pearson Education.
2. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson, PHI.

Reference Books:

1. Artificial Intelligence and Soft Computing Behavioral and Cognitive Modeling of the Human Brain - Amit Konar, CRC Press.
2. Artificial Intelligence - Elaine Rich and Kelvin Knight, TMH.

Paper Name: SOFT COMPUTING					
Paper Code: MCAP2250					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand soft computing concepts, technologies and their role in problem solving.
2. Analyze the genetic algorithms and their applications to solve single-objective and multi-objective optimization problems.
3. Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.
4. Comprehend the concept of fuzziness involved in various systems and fuzzy set theory.
5. Understand the knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
6. Understand the need for approximate analysis and computation methods and use the tenets of rough set theory in developing applications.
7. Effectively use of evolutionary algorithms.
8. Analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently.

Module I [8L]

Introduction

Introduction to soft computing, Different tools and techniques, Usefulness and applications.

Genetic algorithm (GA)

Basic concepts, Working principle, Encoding, Fitness function, Genetic modeling: Inheritance, Selection, Cross over, Mutation, Bitwise operator, Convergence of GA, Overview of Multi-Objective Genetic Algorithm (MOGA).

Module II [10L]

Neural Network

Structure and function of biological neuron, Artificial neuron, Definition of Artificial Neural Network (ANN), Taxonomy of neural net, Difference between ANN and human brain, Characteristics and applications of ANN, Single layer network, Multilayer Perceptron(MLP), Linear separability, Different activation functions, Back propagation algorithm, Basic concept of convolution and recurrent neural network, Applications of neural networks.

Module III [12L]

Fuzzy sets and Fuzzy logic systems

Overview of classical set theory, Fuzzy sets and Fuzzy relations, Fuzzy set operations, Properties of Fuzzy sets, Cardinality, Properties of Fuzzy relations.

Membership functions

Features of membership functions, Standard forms and boundaries, Standard Fuzzification methods.

Fuzzy to Crisp conversions

Lambda cuts for Fuzzy sets, Fuzzy relations, Defuzzification methods, Overview of classical predicate logic, Fuzzy logic, Approximate reasoning and Fuzzy implication.

Fuzzy rule based systems:

Linguistic hedges, Fuzzy rule based system–Aggregation of Fuzzy rules.

Module IV [10L]

Rough Set

Introduction to Rough sets, Decision table, Indiscernibility relations and set approximation, Reducts & Core, Rough approximation, Decision matrix, Application of Rough set.

Evolutionary Algorithm

Introduction, Key principles of swarm, Overview and application of - Ant colony optimization (ACO), Particle swarm optimization (PSO), Artificial bee colony optimization (ABC)

Text Books:

1. Fuzzy logic with Engineering Applications - Timothy J. Ross, John Wiley and Sons.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms - S. Rajasekaran and G.A.V. Pai, PHI.

Reference Books:

1. Soft Computing and Its Applications, Volume One: A Unified Engineering Concept, Volume 1 –Kumar S. Ray, CRC Press.
2. Genetic Algorithms in search, Optimization & Machine Learning - David E. Goldberg, Pearson India.
3. Artificial Neural Networks - B. Yegnanarayana, PHI.
4. Soft computing - Dilip K. Pratihar, Alpha Science International.

Paper Name: MOBILE COMPUTING					
Paper Code: MCAP2251					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the difference between Mobile Computing and Wireless Networking.
2. Learn fundamental concepts of Wireless Networks, different architectures of Wireless Networks and medium access related issues in Wireless Networks.
3. Analyze the performance of different Wireless Networks.
4. Understand the concept of Mobility Management.
5. Learn about various mobile telecommunication systems namely, GSM, GPRS, UMTS, LTE.
6. Understand the protocols for WLAN, WPAN, WWAN and mobile adhoc networks.

Module I [10L]

Introduction

Introduction to mobile computing, Mobile communication vs. wireless communication, Mobile computing applications, Characteristics of mobile computing, Structure of mobile computing application.

Evolution of Mobile Communication Technology

1G, 2G, 2.5G to 5G and standards such as 3GPP, ITU.

Wireless MAC Protocols Wireless MAC issues: Motivation for a specialized MAC (Hidden and exposed station problem, Near-far station), Channel assignment scheme (static and dynamic), Random assignment schemes, Reservation based schemes.

Module II [10L]

Mobile Network Layer Mobile IP (Goals, Assumptions, Entities and terminology), IP packet delivery, Agent advertisement and discovery, Registration, Route optimizations.

Mobile Transport Layer Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/Fast Recovery, Transmission /Time-out Freezing, Selective Retransmission, Transaction Oriented TCP.

Module III [10L]

Mobile Telecommunication Systems Cellular Mobile Computing, Location Tracking, Hand-off Mechanism, Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE).

Module IV [10L]

More on 5G:

Various technological aspects in 5G and it's impact on machine-to-machine communications.

Mobile Ad-Hoc Networks Ad-Hoc basic concepts, Characteristics, Applications, Design issues, Routing, Essential of traditional routing protocols, popular routing protocols, Security issues in MANETs.

Text Books:

1. Fundamentals of Mobile Computing – P. K. Pattnaik, R. Mall, PHI Learning Pvt. Ltd.
2. Mobile Communications – J. H. Schiller, Pearson Education.

Reference Books:

3. Mobile Computing – Sipra DasBit and Biplab K. Sikdar, PHI.
1. Principles of Mobile Computing – U. Hansmann, L. Merk, M. S. Nicklons and T. Stober, Springer.
2. Introduction to Wireless and Mobile systems – D. P. Agarval, Qing and An Zeng, Thomson Asia Pvt Ltd.
4. Mobile Cellular Telecommunications-Analog and Digital Systems – William. C. Y. Lee, Tata Mc Graw Hill Edition.
5. AdHoc Mobile Wireless Networks – C. K. Toh, Pearson Education.

Paper Name: COMPILER DESIGN					
Paper Code: MCAP2252					
Contact hrs per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Understand the overall hierarchy of formal instructions from source code to machine code.
2. Analyze the Chomsky hierarchy of formal grammar that is suitable in abstracting the formal languages.
3. Analyze the steps of two phase compilation.
4. Combine the ideas of both analysis and synthesis in culminating the final low level binary instructions.
5. Recognize the role of a new compiler when forming a formal language.
6. Able to frame a context free grammar that can combine the hierarchical features of a language.

Module I - [10L]

Compilation Basics

Analysis of the source program, Different phases of Compilation. One /Two Pass Compilers.

Lexical Analysis

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering. Specifications of a token, Token Recognition, Lexical Analyzer Generator (Lex).

Finite Automata

Conversion from Regular Expression (RE) to NFA, NFA to DFA, Regular expression to DFA.

Module II - [10L]

Language and Grammar

Chomsky Classification of Grammar, Context free grammars.

Syntax Analysis

The role of a parser, Top down Parsing, Nonrecursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Module III - [10L]

Syntax Directed Translation

Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Run Time Environment

Run time environments Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory,

Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module IV - [10L]

Intermediate Code Generation

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code Optimization & Final Code Generation

Code optimization Introduction, Basic blocks & flow graphs, Optimization of basic blocks, Principle sources of optimization, Loops in flow graph, Peephole optimization. Code generations Issues in the design of code generator, A simple code generator, Register allocation & assignment.

Text Books:

1. Compiler Design, Aho, Ullman, Sethi & Lam, Pearson
2. Compiler Design, O.G. Kakde, University Science Press

Reference Books:

1. Compiler Design in C, Allen Holub, Prentice Hall
2. Engineering a Compiler, Keith Cooper & Linda Torczon, Morgan Kaufmann
3. Compiler Design, Santanu Chattopadhyay, PHI

Paper Name: MANAGEMENT SUPPORT SYSTEM					
Paper Code: MCAP2253					
Contact hrs per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Discuss about DSS concept and components
2. Describe the data and model management for DSS
3. Describe about various DSS functionality
4. Understand Data warehousing and Data mining concept.
5. Discuss Knowledge Management

Module I [10 L]:

Support Systems: Changing Business Environment, Managerial Decision Making, Computerized Support, Concept of Decision Support Systems, Major Tools and Techniques for Management Support System.

Decision Support: Decision Making, Introductory and Definitions, Models, Phases of Decision Making.

Decision Support Systems: Definition, Configuration, Characteristics, And Components of DSS: Dialogue Management, Data Management and Model Management for DSS. An overview of DSS generators; Group Decision in Support Systems (GDSS) and Decision Conferencing, Collaborative Computing Technologies.

Module II [10 L]:

Modeling and Analysis: Modeling for MSS, Static and dynamic models, Certainty, Uncertainty and Risk, MSS Modeling in Spreadsheets, Simulation, Optimization via Mathematical Programming

Data Warehousing Data Warehousing definitions and concepts, Process Overview, architecture, development, administration and security issues.

Module III [10L]

Business Analytics and Data Visualization: Overview, Online Analytical Processing(OLAP), Data Visualization, GIS, Usage, Benefits and success

Data Mining: Concepts and Applications, Tools and Techniques, Text Mining, Web Mining

Neural Networks: Concept, ANN, Applications, development of Neural Network based system

Module IV [10 L]

Knowledge Management: Introduction, activities, approaches, information technology, role of people, success

Knowledge-Based Decision Support: Concepts and Definitions of Artificial Intelligence and Expert Systems, Benefits, Problems and limitations, Success factors.

Text Books:

1. Decision Support Systems: Concepts and Resources for Managers, Daniel Power, 2002, Greenwood Publishing Group
2. Management Support Systems, Harry Katzan, 1984, Van Nostrand Reinhold Company

Reference Books:

1. Decision Support Systems, K. Sarukesi, 2004, PHI Learning Pvt. Ltd.
2. Decision Support and Expert Systems: Management Support Systems, Efraim Turban, 1995, Prentice Hall

Paper Name: ADVANCED UNIX PROGRAMMING					
Paper Code: MCAP2260					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the basic commands of Unix operating system and can write shell scripts.
2. Create file systems and directories and operate them.
3. Create processes background and fore ground etc..by fork() system calls.
4. Create shared memory segments, pipes ,message queues and can exercise interprocess communication.
5. To be able to design and build an application/service over the unix operating system.

Module I [10L]

Problem solving approaches in UNIX:

Using single commands, using compound Commands, shell scripts, C programs, building own command library of programs. Working with the Bourne shell: Introduction, shell responsibilities, pipes and input Redirection, output redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

Module II [10L]

Unix Files: File Concept, File Structure, File System Layout, File types, The standard I/O (fopen, fclose, fflush, fseek, fgetc, getc, getchar, fputc, putc, putchar, fgets, gets etc.), formatted I/O, stream errors, kernel support for files, System calls, library functions, file descriptors, low level file access -usage of open, creat, read, write, close, lseek, stat family, umask, dup, dup2, fcntl. file and directory management - chmod, chown, links(soft links & hard links - unlink, link, symlink), mkdir, rmdir, chdir, getcwd, opendir, readdir, closedir, rewinddir, seekdir, telldir functions.

Basics of Perl - Scalars and their operations, assignment statements and simple I/O, control statements, arrays, hashes, references, functions, pattern matching, file I/O, example programs.

Module III [10L]

Unix Process – Process concept, Kernel support for process, process attributes, process hierarchy, process creation, waiting for a process, process termination, process control, zombie process, system call interface for process management-fork, vfork, exit, wait, waitpid, exec family, system.

Unix Signals – Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions.

Interprocess Communication Overview: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, file and record locking, other unix locking techniques, pipes, FIFOs, namespaces, introduction to three types of IPC(system-V)-message queues, semaphores and shared memory.

Module IV [10L]

Message Queues-Unix system-V messages, unix kernel support for messages, unix APIs for messages, client/server example.

Semaphores-Unix system-V semaphores, unix kernel support for semaphores, unix APIs for semaphores, file locking with semaphores.

Shared Memory-Unix system-V shared memory, unix kernel support for shared memory, unix APIs for shared memory, semaphore and shared memory example.

Sockets: Berkeley sockets, socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs.

Text Books:

1. Unix Network Programming, W. R. Stevens, Pearson/PHI.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Unix system programming using C++, T. Chan, PHI.

Reference Books:

1. Linux System Programming, Robert Love, O'Reilly, SPD.
2. Unix for programmers and users, 3rdEdition, Graham Glass, King Ables, Pearson Education.
3. Advanced Programming in the Unix environment, 2ndEdition, W. R. Stevens & S. A. Rago, Pearson Education.
4. Learning Perl, R. L. Schwartz, T. Phoenix, B.D. Foy, O'Reilly, SPD.
5. Unix Programming, Kumar Saurabh, 1st Edition, Wiley India Pvt Ltd.

Paper Name: CLOUD COMPUTING					
Paper Code: MCAP2261					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the benefits and limitations of cloud based computing environments
2. Understand the underlying principles of cloud virtualization, cloud storage, cloud security
3. Analyze the suitability and applicability of various cloud computing models, platforms, services, solution offerings and tools from some industry leaders
4. Gain insight into various distributed computing issues (like performance, scalability, availability, reliability) in light of distributed file systems (such as HDFS, GFS)
5. Identify security and privacy issues in cloud computing
6. Become familiar with application development and deployment cloud platforms –Amazon and Google

Module I - [10L]

Basics of Cloud Computing

Defining a Cloud, Cloud Types – NIST Cloud Reference Model, Cloud Cube Model, Deployment Models – Public, Private, Hybrid, and Community Clouds, Service Models – Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), Characteristics of Cloud Computing, Benefits and Limitations of Cloud Computing

Module II - [10L]

Cloud Services and Applications

IaaS – Basic Concept and Characteristics, Virtual Machine Instances / Images, Examples of IaaS
PaaS – Basic Concept and Characteristics, Tools and Development Environment with examples
SaaS – Basic Concept and Characteristics, Open SaaS and SOA, examples of SaaS solutions
Identity as a Service (IdaaS), Introduction of Containerization & CaaS (Containers as a Service)

Module III - [10L]

Cloud Solution Offerings

Concepts of Abstraction and Virtualization - Virtualization: Taxonomy of Virtualization Techniques, Hypervisors: Machine Reference Model for Virtualization

Commercial Solutions –

Amazon Web Services Components and Services – Compute, Storage, Database, Content Distribution, Deployment

Google Applications Portfolio – AdWords, Analytics, Overview of GWT, Google APIs, key services of GAE

Module IV - [10L]

Cloud Storage and Security

Cloud-based Storage - Block and File Devices, Managed and Unmanaged Storage, File Systems – GFS and HDFS

Cloud Security - Security Concerns, Security Boundary, Security Service Boundary, Security Mapping Overview, Data Security, Identity Management

Introduction of Containerization

CaaS (Containers as a Service), Docker and Kubernetes.

Text Books:

1. Mastering Cloud Computing – Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Pvt. Ltd.
2. Cloud Computing Bible – Barrie Sosinsky, Wiley India Pvt. Ltd.

Reference Books:

1. Cloud Computing: Theory and Practice – Dan Marinescu, Morgan Kaufmann.
2. Cloud Computing: A Hands-on Approach – A Bahga and V Madisetti, Self Published.
3. Cloud Computing: A Practical Approach for Learning and Implementation – A Srinivasan and J Suresh, Pearson, 2014
4. Cloud Computing – U S Pande and Kavita Choudhary, S Chand.

Paper Name: CRYPTOGRAPHY AND NETWORK SECURITY					
Paper Code: MCAP2262					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Describe network security services and mechanisms.
2. Acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity of data
3. Understand symmetric and asymmetric key cryptography.
4. Understand the various key distribution and management schemes.
5. Understand various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.
6. Design security applications in the field of Information technology.

Module I - [10L]

Introduction to Security

Security Goals, Threats, Vulnerabilities and Attacks, Types of Attacks, Security Services and Mechanisms.

Mathematical Foundation

Number theory, Congruencies, Modular Arithmetic, Chinese Remainder Theorem, Fermat and Euler's Theorem, Finite Fields, Discrete Logarithm.

Module II - [10L]

Symmetric Key Encryption

Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers, Simple DES, DES Analysis, Double and Triple DES, RC4.

Module III - [10L]

Asymmetric Key Encryption and Hash Functions

Diffie-Hellman Key Exchange, RSA, ElGamal Public Key Encryption, SHA4, SHA5, MD5, Digital Signature.

Module IV - [10L]

Network Security Applications

Authentication Applications: Kerberos, X509, Public Key Infrastructure.

Electronic Mail Security – PGP, S/MIME.

IP and Web Security – IPSec, SSL, TLS, SET.

System Security

Intruders, Malicious Software, Viruses, Worms, Bots, Rootkits, Firewalls, Security Standards.

Wireless Network Security

Authentication and Authorization in Wireless LANs, Data Protection in Wireless LANs.

Text Books:

1. Cryptography and Network Security: Principals and Practice – William Stallings, Pearson Education India.
2. Cryptography and Network Security – Forouzan & Mukhopadhyay, McGraw Hill Education.

Reference Books:

1. Cryptography and Network Security: Principals and Practice – Atul Kahate, Tata MCGraw Hill.
2. Cryptography: Theory and Practice – D.R. Stinson, CRC Press.
3. Applied Cryptography – B. Schneier, Wiley.
4. Network Security: Private Communication in a Public World by – Charlie Kaufman, Radia Perlman and Mike Speciner, Prentice Hall India.

Paper Name: ECOMMERCE AND ERP					
Paper Code: MCAP2263					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Define and differentiate various types of E-commerce.
2. Describe Hardware and Software Technologies for E-commerce.
3. Explain payment systems for E-commerce.
4. Understand legal and moral issues in the digital age.
5. Understand an Enterprise and Resource Management Perspective.
6. Understand Information System perspective and Key Managerial issues.

Module I [10L]

Introduction to E-Commerce

Definition, Scope, Advantages and disadvantages of e-commerce, Electronic Commerce applications. E-Commerce Organization model based on transaction type, Model based on Transaction Party. E strategy: Overview, Strategic methods for developing E-commerce Management Call Center. Electronic payment systems: Digital payment systems; First virtual Internet payment system; Cyber cash model.

Module II [9L]

E-Payment Mechanism

Payment through card system, Electronic Data Interchange (EDI): Concepts, Benefits and applications; EDI model, EDI protocols (UN EDI FACT / GTDI, ANSI_X 12), Data encryption (DES / RSA). Risk of e-commerce: Overview, Security for e-commerce, Security standards, Firewall, Cryptography, Key management, Password systems, Digital certificates, Digital signatures.

Module III [10L]

Enterprise Resource Planning (ERP)

Introductory concepts: Scope, Benefits, Importance of ERP in the E-Business era. Supply Chain Management: Role of ERP in SCM, ERP features and capabilities. Overview of commercial software, Re-engineering work processes for IT applications, Business process redesign, Knowledge engineering and data warehouse, Advantages & disadvantages of ERP.

Module IV [11L]

ERP Business Modules

Introduction to basic modules of ERP system. Resource management in global scenario. Workflows in ERP, ERP and Corporate Portal, ERP implementation: ERP Life Cycle Model, Information systems planning, Critical Success Factors of ERP implementation, Extended ERP applications: Customer Relationship Management, Supply Chain

Management, Product Life Cycle Management. Case Study: ERPasan Integrated System.

Text Books:

1. Electronic Commerce - Peter Loshin, John R. Vacca, Charles River Media.
2. Concepts in Enterprise Resource Planning - Ellen Monk, Bret Wagner, CENGAGE Learning India.

Reference Books:

1. E-Commerce - K.K. Bajaj, D. Nag, McGraw-Hill Education.
2. E-Commerce An Indian Perspective - P.T. Joseph, PHI Publication.
3. Electronic Commerce-Technology and Application- Bhaskar Bharat, McGraw-Hill Education.
4. Enterprise Resource Planning - Mary Sumner, PHI Learning India Pvt. Ltd.

Paper Name: FOUNDATIONS OF DECISION PROCESSES					
Paper Code: MCAP2264					
Contact hrs per week:	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Describe various methods to define role of decision making.
2. Understand and apply game theory and competitive strategies.
3. Describe and apply various queuing models.
4. Describe and solve problems in Finance.
5. Understand Systematic problem analysis

Module I [10L]

Decision Making

Role of decision making in management-Framework-Criteria under conditions of certainty- risk and uncertainty-Bayes' theorem-Sequential decision making decision tree analysis. Theory of utility. Utility function curve.

Module II [10L]

Competitive Strategies

Competitive strategies, game theory.

Queuing model. Single channel, single phase waiting line model with Poisson. Distributed arrival rates and exponentially distributed service times. Markov models.

Module III [10L]

Simulation

Simulation: Monte Carlo- Application to queuing and inventory models-Applications in functional areas of marketing, production.

Module IV [10L]

Systematic Problem Analysis

Systematic problem analysis and decision making. Decision making in functional areas - case studies.

Text Books:

1. Decision analysis - Gregory, G., Pitman, London.
2. Quantitative Techniques for Business Decisions - Johnson. R. D., et. al., Prentice Hall.

Reference Books:

1. Foundations of Decision Analysis - Ronald A. Howard, Ali E. Abbas, Pearson.
2. Introduction to decision analysis - David C. Skinner.

Paper Name: COMPUTER NETWORK LAB					
Paper Code: MCAP2211					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Understand the TCP/IP configuration for Windows and Linux.
2. Implement device sharing on network.
3. Learn the major software and hardware technologies used on computer networks
4. Learn the terminology and concepts of network management in Linux platform by understanding shell commands and implementing the same.
5. Understand the concepts of protocols, network interfaces, and design/performance issues through programs.

UNIX Fundamentals

1. Basic UNIX Commands
2. Writing Shell Scripts

Network Programming on the following (To be implemented in Java/C/C++)

1. IPC: a) Pipes b) FIFO
2. File transfer using message queue form of IPC
3. TCP sockets (like date and time server & client, echo server & client, etc.)
4. UDP sockets (like simple DNS)
5. Raw sockets (like packet capturing and filtering)
6. Sliding window protocol and cyclic redundancy check
7. Routing protocols
8. Study of TCP/UDP performance
9. TCP client and server application to transfer file
10. UDP client and server application to transfer a file
11. RPC

Testbed Development and Simulators

1. Creating a LAN
2. Use of Network Simulators for Network Modeling (basic ideas/ demonstration only)

Paper Name: WEB TECHNOLOGY LAB					
Paper Code: MCAP2212					
Contact hrs per week	L	T	P	Total	Credit Point
	3	1	0	4	4

Course Outcomes:

1. Develop the web pages using HTML.
2. Combine the styles to web pages using CSS.
3. Apply JavaScript validations in the Forms.
4. Retrieve data from XML Files Using Parsers.
1. Connect a server side program using PHP with Database Connectivity MySQL to perform insert, update and delete operations on DBMS table.

HTML

1. Web page design using tables, header, footer and menu.
2. Creating a form with support for redirection to other page(s).
3. Designing CSS with Bootstrap features to allow for responsive web content.

JAVASCRIPT

1. Create dynamic web pages by modifying features of HTML tags.
2. Validate the fields of a form.
3. Create simple animations.

XML

1. How to write a XML document.
2. How to validate XML document.

PHP

1. Writing methods to implement GET and POST requests.
2. Implementing cookies and sessions.
3. Writing PHP and HTML in open source environment.

DATABASE CONNECTIVITY

1. Connecting to database in web server.
2. Query processing to retrieve data from database and update tables.

Subject: CAREER DEVELOPMENT AND MANAGEMENT					
Paper Code: HMTS2221					
Contact hrs per week	L	T	P	Total	Credit Point
	0	0	3	3	2

Course Outcomes:

1. Employ the technique of SWOT analysis to decide goals and plans.
2. Be able to map their skills according to the basic job profile.
3. Upgrade and enhance generic and specific skills.
4. Be aware of the dynamics of communication under diverse cultural setup.
5. Be aware of the start-up ecosystem in India & acquire tools to take up entrepreneurship as a career opportunity.
6. achieve work-life balance by managing both organizational and personal crisis.

Module I: Professional Growth

Self-Growth: Anger, stress and time management-Theories and application, SWOT analysis.
Skill identification and Skill up gradation- (generic and specific), Local and global skills,
Knowledge sources such as MOOC, NPTEL
Career Planning-Skill mapping to job profile, Basic and add-on qualifications, Career growth,
Self-appraisal, Lifelong learning

Assessment - Activity (20 marks)

Module II: Professional Communication

Impression Management
Employability Quotient
Cross-cultural communication
Leadership & Team Playing: Theories, Styles, Stages
Motivation, Negotiation Skills, Conflict Management
Planning & Envisioning: Initiative and Innovation in the Work Environment

Assessment- Written (30 marks)

Module III: Entrepreneurship

The start-up ecosystem in India- Why entrepreneurship? Indian tech start-up landscape, Stand-up
India policies, funding agencies, market development, trends and best practices
E-Commerce- India as a growing E-commerce market, Possibilities of growth, funding, niche
retailers
Make in India- New processes, Investments, Focus sectors, Makers of Make in India,
Opportunities and Policies

Assessment- Project (30 marks)

Module IV: Working and living happily

Managing crisis- Organizational and personal crisis, Analyzing crisis, Turnaround strategies, learning from crisis as opportunity.

Work-life balance- Performance-expectation management, Personal and professional goal-mapping Understanding happiness- Components, Conflicts, Happiness Index

Assessment: Activity/case (20 marks)

Reference Books:

1. Basic Managerial Skill for All - E. H. McGrath.SJ., PHI, New Delhi.
2. The Start-up Equation - Steven Fisher and Jae-Nae Duane, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi.
3. Live Happily, Work Happily - Siddhartha Ganguli, Allied Publishers Pvt.Ltd. New Delhi.
4. Crisis Management: Planning for the Inevitable - Steven Fink, iUniverseInc.USA.
5. Influencer: The New Science of Leading Change - Joseph Grenny& Kerey Patterson, McGraw Hill Education , USA.
6. Soft Skills: An Integrated Approach to Maximise Personality - Gajendra Singh Chauhan and Sangeeta Sharma, Wiley.