Master of Computer Application

MCA PROGRAMME

Release Month & Year : July 2018

Course Structure

1st Year 1st Semester:

A. THEORY							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP1101	Digital Logic Design	3	-	-	3	3
2	MCAP1102	Introduction to Programming	3	1	-	4	4
3	MCAP1103	Numerical and Statistical Techniques	3	1	-	4	4
4	MCAP1104	Discrete Mathematics	3	-	-	3	3
5	MCAP1105	Management Information System	3	-	-	3	3
6	HMTS1102	Technical Communication	3	-	-	3	3
Total of Theory						**20**	**20**
B. PRACTICAL							
7	MCAP1111	Digital Logic Lab	-	-	4	4	3
8	MCAP1112	Programming Lab	-	-	4	4	3
9	HMTS1112	Language Practice Lab	-	-	4	4	3
Total of Practical						**12**	**9**
Total of Semester						**32**	**29**

1st Year 2nd Semester:

A. THEORY							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP1201	Object Oriented Programming with Java	3	1	-	4	4
2	MCAP1202	Data Structures	3	1	-	4	4
3	MCAP1203	Database Management Systems I	3	1	-	4	4
4	MCAP1204	Optimization Techniques	3	-	-	3	3
5	MCAP1205	Computer Organization and Architecture	3	-	-	3	3
6	HMTS1201	Principles of Management and Accounting	3	-	-	3	3
Total of Theory						**21**	**21**
B. PRACTICAL							
7	MCAP1211	Object Oriented Programming Lab	-	-	4	4	3
8	MCAP1212	Data Structures Lab	-	-	4	4	3
9	MCAP1213	DBMS I Lab	-	-	4	4	3
Total of Practical						**12**	**9**
Total of Semester						**33**	**30**

2nd Year 1st Semester:

A. THEORY							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP2101	Design and Analysis of Algorithms	3	1	-	4	4
2	MCAP2102	Data Communication & Computer Networks	3	1	-	4	4
3	MCAP2103	Database Management Systems II	3	1	-	4	4
4	MCAP2104	Operating Systems	3	1	-	4	4
5	CHEM2101	Environment and Ecology	3	-	-	3	3
Total of Theory						**19**	**19**
B. PRACTICAL							
6	MCAP2111	Algorithms Lab	-	-	4	4	3
7	MCAP2112	UNIX and Network Programming Lab	-	-	4	4	3
8	MCAP2113	DBMS II Lab	-	-	4	4	3
Total of Practical						**12**	**9**
Total of Semester						**31**	**28**

2nd Year 2nd Semester:

A. THEORY							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP2201	Software Engineering	3	1	-	4	4
2	MCAP2202	Web Technology	3	1	-	4	4
3	MCAP2203	Computer Graphics	3	1	-	4	4
4	MCAP2204	Intelligent Systems	3	1	-	4	4
5	HMTS2201	Professional Ethics	3	-	-	3	3
Total of Theory						**19**	**19**
B. PRACTICAL							
6	MCAP2211	Software Engineering Lab	-	-	4	4	3
7	MCAP2212	Web Technology Lab	-	-	4	4	3
8	MCAP2213	Graphics Lab	-	-	4	4	3
Total of Practical						**12**	**9**
C. SESSIONAL							
9	HMTS2221	Career Development and Management	-	-	3	3	2
Total of Sessional						**3**	**2**
Total of Semester						**34**	**30**

3rd Year 1st Semester:

A. THEORY							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP3150 to 3152	Elective I	3	1	-	4	4
2	MCAP3160 to 3162	Elective II	3	1	-	4	4
3	MCAP3170 to 3172	Elective III	3	1	-	4	4
4	MCAP3180 to 3183	Elective IV	3	1	-	4	4
Total of Theory						**16**	**16**
B. PRACTICAL							
5	MCAP3155 to 3157	Elective I Lab	-	-	4	4	3
Total of Practical						**4**	**3**
C. SESSIONAL							
6	MCAP3195	Minor Project and Seminar	-	-	12	12	10
Total of Sessional						**12**	**10**
Total of Semester						**32**	**29**

Electives for 3rd Year 1st Semester:

ELECTIVE NO	COURSE CODE	TOPIC
Elective I	MCAP3150	System Administration using Linux
	MCAP3151	Advanced Java
	MCAP3152	Image Processing
Elective II	MCAP3160	Cryptography and Network Security
	MCAP3161	Theory of Computing
	MCAP3162	Big Data Analysis
Elective III	MCAP3170	Mobile Computing
	MCAP3171	Soft Computing
	MCAP3172	Data Mining and Data Warehousing
Elective IV	MCAP3180	High Performance Computing
	MCAP3181	Parallel and Distributed Computing
	MCAP3182	Compiler Design
	MCAP3183	Ecommerce and ERP
Elective I Lab	MCAP3155	System Administration Lab
	MCAP3156	Advanced Java Lab
	MCAP3157	Image Processing Lab

3rd Year 2nd Semester:

A. SESSIONAL							
SERIAL NO	**PAPER CODE**	**PAPER NAME**	**CONTACTS (PERIODS/WEEK)**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCAP3221	Comprehensive Viva	-	-	-	-	10
2	MCAP3295	Major Project and Seminar	-	-	-	-	20
Total of Sessional						**-**	**30**
Total of Semester						**-**	**30**

Summary

Semester No.	Contact hr/wk	Credit
1	32	29
2	33	30
3	31	28
4	34	30
5	32	29
6	-	30
Total		176

Detailed Syllabus

1st Year 1st Semester

Paper Name: DIGITAL LOGIC DESIGN					
Paper Code: MCAP1101					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [10L]

Number System

Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Fixed point representation of fractional number. Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.

Module II [10L]

Logic gates- truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, Kmap method, Quine Mc Clusky'sMethod.

Module III [10L]

Combinational Circuits and Memory

Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Multiplexer, De-Multiplexer and Parity Generator. Overview of Memory Systems. Design of combinational circuits-using ROM. Overview of Programming logic devices and gate arrays (PLAs and PLDs).

Module IV [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.

Text Books:

1. Digital Logic and Computer Design - M. Morris Mano, Pearson.
2. Digital Logic Design, MansafAlam-Bashir Alam, PHI.

Reference Books:

1. Digital Design: Basic Concepts and Principles - Mohammad A. Karim, CRC Press.
2. Digital Logic Design Principle - Bradley Carlson, Norman Balabanian, Wiley India.

Paper Name: DIGITAL LOGIC LAB					
Paper Code: MCAP1111					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Problems related to

- Basic skills lab in using Personal Computer and common software tools
- Realization of Logic Gates
- Realization of Flip- Flop using logic gates
- Realization of Multiplexer
- Realization of Coder & Decoder
- Realization of Adder and Subtractor using logic gates

Paper Name: INTRODUCTION TO PROGRAMMING					
Paper Code: MCAP1102					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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 McGraw Hill.

Reference Books:

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

Subject Name: PROGRAMMING LAB					
Paper Code: MCAP1112					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Programs related to

- Control Structures
- Array (1-d, 2-d)
- Functions
- Dynamic Memory Allocation
- String Handling
- Structures, Union
- File Handling

Paper Name: NUMERICAL AND STATISTICAL TECHNIQUES					
Paper Code: MCAP1103					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

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, Independent Events, Bayes' Theorem and Related Problems.

Random Variable and Probability Distribution

Probability Mass Function, Probability Density Function and Distribution Function, Distributions: Binomial, Poisson and Normal Expectation and Variance, Moment Generating Function, Reproductive Property of Binomial, Poisson and Normal Distribution (proof not required), Chebychev's Inequality (statement) and Problems.

Module II [10L]

Sampling and Estimation

Population, Sample; Statistic, Estimation of Parameters (consistent and unbiased), Sampling Distribution of Sample Mean and Sample Variance (proof not required), Point Estimation.
Overview of Testing of Hypothesis, Type I and Type II errors.

Module III [10L]

Numerical Analysis and Errors

Introduction, Sources of Errors, Significant Figures: Absolute, Relative and Percentage Errors.

Interpolation

Introduction, Lagrange's Interpolation Formula, Divided Differences and Properties, Newton's Forward & Backward Interpolation Formula, Newton's Divided Difference Formula, Error in Difference Table, Problems and Solutions.

Numerical Differentiation and Integration

Differentiation based on Newton's Forward and Backward Interpolation Formula. Trapezoidal Rule and Simpson's $1/3^{rd}$ Rule, Errors in Numerical Integration Formulae, Problems and Solutions.

Module IV [10L]

Solution of System of Linear Equations

Introduction, Gauss Elimination Method and Gauss-Seidel Method, Problems and Solutions.

Solution of Algebraic and Transcendental Equation

Introduction, Bisection Method, Regula-Falsi Method, Newton-Raphson Method, Problems and Solutions.

Solution of Ordinary Differential Equations

Introduction, Euler's Method, Runge-Kutta Method (2nd and 4th order), Modified Euler's Method, Problems and Solutions.

Text Books:

1. Statistical Methods (Volume 1 and 2) – N. G. Das, TMH.
2. Introductory Numerical Analysis – Dutta and Jana, Shreedhar Prakashani.

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. Numerical Analysis and Computational Procedures - S. Ali Mollah, Books & Allied Ltd.
4. Numerical Mathematical Analysis - James B. Scarborough, Oxford & Ibh.

Paper Name: DISCRETE MATHEMATICS					
Paper Code: MCAP1104					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [10L]

Abstract Algebra
Overview of Discrete Mathematics, Set, Relations, Mappings, Poset, lattice, Hasse diagram, Vector Space.

Boolean algebra
Definition of Boolean algebra, Boolean function Simplification.

Mathematical Logic
Propositions, Connectives, Conditionals and Biconditionals, Well Formed Formulas (WFF), Tautologies, Equivalence formulas, duality law, Normal Forms, Predicate Calculus, free and bound variables.

Module II [10L]

Permutation and Combination
Concepts of Permutations and Combinations, Pigeon-hole principle, Euclidean algorithm for Linear Diophantine Equation, Basic Counting Concepts, problems, solutions.

Generating- function and Recurrence- relation
Generating Function, Recurrence relations, Linear recurrence relations with constant Coefficients, Solution by Generating Function.

Module III [10L]

Graph Theory
Basic Concepts of Graphs, Trees, Forest, Adjacency and Incidence Matrices, Minimum Spanning Tree (Prim's and Kruskals Algm), Shortest Path (Dijkstra's Algm), Planar Graph. Various applications of Graph Theory in Computer Science.

Module IV [10L]

Mathematical Computing
Finite Automata, Finite Automata - Construction, DFA, NFA, 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 - K.H. Rosen, TMH.
2. Elements of Discrete Mathematics - C.L. Liu, McGraw-Hill.
3. Discrete Mathematical Structures - Kolman, Busby and Ross, PHI.

Reference Books:

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

Paper Name: MANAGEMENT INFORMATION SYSTEM					
Paper Code: MCAP1105					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [10L]

Introduction to systems and Basic systems concepts, Types of systems, The systems Approach, Information systems-Definition and characteristics, types of Information, role of Information in Decision Making.

Introduction to Information Analysis and Design Tools-Decision Tree, Decision Table, Structured Analysis, Dataflow Analysis, Data dictionary, Structured Flow Chart, HIPO, Warnier/ORR diagram

Module II [10L]

An overview of Management Information System: Definition and Characteristics, Components of MIS, Hierarchy of Management Activity. Information requirements and Levels of Management, Model of decision making, structured Vs un-structured decisions, Formal vs Information systems

Module III [10L]

Storage and retrieval of data -transaction processing, office automation and information processing, Virtual office system, control functions, Decision making process, phases in the decision making process, Intelligence and design phases, concepts of decision making, Behavioral models of the decision maker/decision making

Module IV [10L]

Planning & implementation of Information Systems, Executive information Systems, Decision Support Systems, Expert Systems, Knowledge Based System. Introduction to Computer crime, Security & ethical challenges.

Text Books:

1. Management Information System - W.S.Jawadekar, TMH.
2. Management Information Systems - Loudon and Loudon, Pearson/Prentice Hall.
3. Analysis & Design of Information System - James A. Senn, McGraw Hill Education.

Reference Books:

1. Management Information Systems – Conceptual foundations, Structure and Development - Gordon B. Davis, Margrethe H. Olson.
2. Management Information System – Oz, Thomson Learning.
3. Management Information System - James O'Brien, TMH.
4. Information Systems: Foundation of E-Business - Steven Alter, Pearson Education.

Paper Name: TECHNICAL COMMUNICATION					
Paper Code: HMTS1102					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

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 & non-literary expression
Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)

Module IV [10L]

Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) -to be dealt with the help of the given texts.

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/ Irwin.
3. Intercultural Business Communication - Lillian Chaney and Jeanette Martin, Prentice Hall.

Paper Name: LANGUAGE PRACTICE LAB					
Paper Code: HMTS1112					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Module I

Introduction to Linguistics
Phonetics-Vowel and Consonant Sounds (Identification &articulation)
Word- stress, Intonation (Falling and rising tone), Voice Modulation, Accent training
Conversational Skills

Module II

Writing Skill
Writing Dialogue- (formal and informal)
Descriptive, narrative and expository writing
Writing with a purpose---Convincing skill, argumentative skill/negotiating Skill (These skills will be repeated in oral skills).
Writing reports/essays/articles—logical organization of thoughts
Job Application Letter
CV& Resume
Book review

Module III

Major Areas of Formal, Verbal Communication
Interpersonal Speaking & Public Speaking
Group Discussion
Oral Presentation, both technical and general
Interview Techniques

1st Year 2nd Semester

Paper Name: OBJECT ORIENTED PROGRAMMING WITH JAVA					
Paper Code: MCAP1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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.

Module III [10L]

Inheritance

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

Interface

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

Package

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

Module IV [10L]

Exception Handling

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

Multithreading

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

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. RumBaugh, 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: OBJECT ORIENTED PROGRAMMING LAB					
Paper Code: MCAP1211					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Programs related to

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

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

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, McGraw Hill.
2. Fundamentals of Data Structures in C -Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed,Universities Press.

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

Programs related to

- 1-D and 2-D array
- Linked List (Singly linked list, Circular Linked List, Doubly Linked List)
- Stack and Queue implementation using array and linked list
- Implementation of different recursive algorithms
- Implementation of Binary Search Tree (insertion, deletion, searching, traversals)
- Different searching and sorting algorithms

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

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

Problems related to

1. Database Creation
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes

2. Table and Record Handling
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements

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

4. Clause
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries

5. Database Management
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

Paper Name: OPTIMIZATION TECHNIQUES					
Paper Code: MCAP1204					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

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 ui'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: COMPUTER ORGANIZATION AND ARCHITECTURE					
Paper Code: MCAP1205					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [12L]

Introduction to basic structures and operational concepts, Instruction formats, Instruction execution, sequencing, Addressing modes Control unit – Concepts, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction, Hardwired control, Microprogrammed control.

Module II [8L]

Fixed point Arithmetic - Arithmetic and logical operations of signed numbers and their implementation,
Hardware Multiplier, Booths' multiplier, Booth pair multiplier, Binary Division restoring and non-restoring. IEEE-754 representation of floating point numbers, overflow and underflow.

Module III [10L]

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. Computer Organization – C. Hamacher, Z. Vranesik, S. Zaky, McGraw Hill.
2. Computer Architecture and Organization – John P. Hayes, McGraw Hill.

Reference Books:

1. Computer System Architecture-Morris Mano, PHI.
2. Computer Organization and Architecture-Williams Stallings.

Paper Name: PRINCIPLES OF MANAGEMENT AND ACCOUNTING					
Paper Code: HMTS1201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [4L]

Introduction to Business Management

Basic concepts, Management Functions, Planning and decision making, scheduling, organizing, staffing, directing, controlling. Manager as Leader. Human Resource Planning, Human resource development and Organizational Development, Organizational Communication.

Module II [4L]

Management for Organization

Management control systems: goals, strategies, Managerial economics and financial management, productivity management**.** Strategic planning. Strategy: firm and its environment, strategies and resources, industry structure and analysis, corporate strategies and its evaluation, strategies for growth and diversification.

Module III [17L]

Accounting Principles & Financial Accounting

Meaning and Scope of accounting, Accounting Concepts, Principles and Conventions, Accounting Standards – concepts, objectives, benefits, Accounting Policies, basic accounting equation, Accounting as a measurement discipline – valuation principles, accounting estimates. Financial accounting, rules of debit and credit, financial statements and analysis, seven basic steps of the accounting cycle for a sole proprietorship and a merchandising business using subsidiary ledgers and special journals. Books of Accounts leading to the preparation of Trial Balance, Journalize entries for uncollectible receivables including the direct write-off method and the allowance method.

Module IV [15L]

Overview of Management and Cost Accounting

Conceptual framework of Management Accounting, Meaning, Scope, Objectives and limitation. Cost–Volume profit analysis: Concept of break-even point, Profit volume relation, Margin of safety, Angle of incidence, Break-even point chart, Break even analysis. Introduction to cost accounting**,** meaning, objectives and advantages of cost accounting.

Text Books:

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

Reference Books:

1. Management Techniques: A Practical Guide - John Argenti.
2. Management Accounting - Khan & Jain, TMH.

2nd Year 1st Semester

Paper Name: DESIGN AND ANALYSIS OF ALGORITHMS					
Paper Code: MCAP2101					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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, graph colouring.

Module IV [10L]

Branch and Bound
General method, least cost search, 15-puzzles problem.

Introduction to NP-completeness
Basic concepts, the classes P, NP, NP-hard and NP-complete, Relative hardness of problems and polynomial time reductions. 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: ALGORITHMS LAB					
Paper Code: MCAP2111					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Programs related to

- (Divide and Conquer) Binary Search, Merge Sort, Quick Sort, finding maximum and minimum element from an array of integers
- (Greedy method) Minimum cost spanning trees by Prim's and Kruskal's algorithm, job sequencing with deadlines
- (Dynamic programming) single source shortest path – Bellman Ford, all pair shortest path – Floyd Warshall, traveling salesman problem
- (Graph traversal) BFS, DFS
- (Pattern matching) brute-force, KMP
- (Backtracking) 8 queens problem
- (Branch and Bound) 15 puzzles problem

Paper Name: DATA COMMUNICATION & COMPUTER NETWORKS					
Paper Code: MCAP2102					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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 andSNMP

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
Introduction to Network Security

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: UNIX AND NETWORK PROGRAMMING LAB					
Paper Code: MCAP2112					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

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)

Reference Books:

1. Advance UNIX Programming - Richard Stevens, Pearson Education.
2. Advance UNIX Programming - N.B. Venkateswarlu, BS Publication.

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

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.

TransactionProcessing
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 Embedded SQL
Pro*C syntax, Host variables, Static Vs. Dynamic SQL.

Introduction to Distributed Database Management System
Distributed DBMS Architecture, Distributed Query Processing, Distributed Concurrency Control, Distributed DBMS Reliability, Parallel Database Systems.

Introduction to Temporal Database Management System
Valid time and transaction time, Discrete bounded linear flow of time and the temporal structure, System-maintained transaction time, Temporal primary keys, Temporal queries at current time, Time points in the past or future or over durations.

Introduction to Object-Oriented Database Management System

Data types and Object, Evolution of Object Oriented Concepts, Characteristics of Object Oriented Data Model.

Object Hierarchies – Generalization, Specialization, Aggregation.

Object Schema. Inter-object Relationships, Similarities and difference between Object Oriented Database model and Other Data models.

Concept of Grid, Cloud and Graph database.

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 – Ramez Elmasri, 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.

Paper Name: DBMS II LAB					
Paper Code: MCAP2113					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Problems on -

- SQL

  Creation of a database objects with constraints. Deletion and modification of database objects.

  Performing Insertion, Deletion, Modification, Alteration and Viewing records based on conditions.

  Creation of Views, Synonyms, Sequence, Indexes, Save points.

- 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

Reference Books:

1. SQL, PL/SQL The Programming Language of Oracle – Ivan Bayross, BPB.

Paper Name: OPERATING SYSTEMS					
Paper Code: MCAP2104					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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, bad blocks.

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: ENVIRONMENT & ECOLOGY					
Paper Code: CHEM2101					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I [9L]

Basic components of Environment & Ecology

Basic ideas of environment and its component.

Mathematics of population growth: exponential and logistic and associated problems, definition of resource, types of resource, renewable, non-renewable, potentially renewable, Population pyramid and Sustainable Development.

General idea of ecology, ecosystem – components, types and function

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain [definition and one example of each food chain], Food web.

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphorus, Sulphur.

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Module II [9L]

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Acid rain: causes, effects and control. Earth's heat budget, carbon capture, carbon footprint

Lapse rate: Ambient lapse rate, adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion, Maximum mixing depth

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

Smog: Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module III [9L]

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides

River/Lake/ground water pollution: River: DO, 5 day BOD test, Unseeded and Seeded BOD test, BOD reaction rate constants, COD.

Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]
Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds]
Water pollution due to the toxic chemicals effects: Lead, Mercury, Cadmium, Arsenic

Noise Pollution
Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index), effective perceived noise level.
Noise pollution control.

Module IV [9L]

Land Pollution
Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, electronic waste
Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Social Issues, Health and Environment
Environmental disasters: Bhopal gas tragedy, Chernobyl disaster, Three Mile Island disaster, cancer and environment: carcinogens, teratogens and mutagens (general aspect)
Environmental impact assessment, Environmental audit, Environmental laws and protection act of India.
Energy audit, Green building, Green sources of energy, Concept of Green Chemistry, Green catalyst, Green solvents (replacement of VOC)

Text Books:

1. Introduction to Environmental Engineering and Science – G.M. Masters, Prentice-Hall of India Pvt. Ltd.
2. Environmental Chemistry – A.K. De, New Age International.
3. Environmental Chemistry with Green Chemistry - Asim K. Das, Books and Allied P. Ltd.

Reference Books:

1. Environmental Science - S. C. Santra, New Central Book Agency P. Ltd.
2. Basic Environmental Engineering and Elementary Biology - GourKrishna Das Mahapatra, Vikas Publishing House P. Ltd.

2nd Year 2nd Semester

Paper Name: SOFTWARE ENGINEERING					
Paper Code: MCAP2201					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

Introduction
Introduction to software engineering, importance of software, the software evolution, software characteristics, software applications, software crisis: problem and causes.

Software Development Life Cycle
Waterfall model, incremental and evolutionary process models, specialized Model – The Unified Process, agile process, and agile models.

Software Requirement Specification
Problem analysis, requirement elicitation and validation, requirements modeling: scenarios, information and analysis classes, flow and behavioral modeling, documenting Software RequirementSpecification (SRS).

Module II [8L]

Software Cost Estimation
Overview of software estimation – size, effort, duration and cost. Size estimation methods – Lines of Code (LOC) and Function Points (FP). Estimation of effort and duration based on size and productivity. Constructive Cost Model (COCOMO) – Basic, Intermediate, Detailed. COCOMO II.

System Design
Design concepts, design models for architecture, component, data and user interfaces; Problem partitioning, abstraction, cohesiveness, coupling, top down and bottom up design approaches.

Module III [12L]

Structured Analysis and Design
Process model using Data Flow Diagram (DFD) with examples. Data dictionary, decision tree, decision table with examples. Data model using Entity Relationship Diagram (ERD) with examples.

Object Oriented Analysis and Design
OOAD basic concepts, Unified Modeling Language (UML) – different types of diagrams for different views of system, User view – Use case diagram with examples, Structural views – Class diagram with examples, Behavioral View – sequence, collaboration, Activity and State Chart Diagrams with examples. Implementation view-Component diagram, Environmental view- Deployment diagram, Functional versus Object Oriented Approach.

Coding
TOP-DOWN and BOTTOM-UP structure programming, information hiding, programming style, internal documentation, verification.

Module IV [10L]

Software Testing

Levels of testing, functional testing, structural testing, test plan, test case specification, software testing strategies, verification &validation, unit and integration testing, Top Down and Bottom Up integration testing, Alpha & Beta Testing, White box and black box testing techniques, system testing and debugging.

Software Maintenance

Types of maintenance – Corrective, Preventive, Adaptive. Change management and maintenance process.

Software Quality Assurance

Software Configuration Management, overview of software quality control and quality assurance, ISO 9000 certification for software industry, SEI Capability Maturity Model (CMM) and comparison between ISO & SEI CMM.

Overview of technical metrics for software and CASE tool.

Text Books:

1. Software Engineering: A Practitioner's Approach - Roger S. Pressman, TMH.
2. Fundamentals of Software Engineering – Rajib Mall, PHI.

Reference Books:

1. Software Engineering - P. Fleeger, Prentice Hall.
2. Analysis and Design of Information System - J. A. Senn, Mc Graw Hill College.
3. Software Engineering - Sommerville, Addison Wesley.
4. Software Testing Tools - K. V. K. K Prasad, Dreamtech Press.

Paper Name: SOFTWARE ENGINEERING LAB					
Paper Code: MCAP2211					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Problems related to

1. Identifying requirements from problem statements
2. Estimation of project metrics
3. Modeling UML Use Case Diagrams and capturing Use Case scenarios
4. E-R modeling from the problem statements
5. Modeling Data Flow Diagrams
6. Identifying domain classes from the problem statements
7. Statechart and Activity Modeling
8. Modeling UML Class Diagrams and Sequence Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing test suites using tools

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

Module I [10L]

Introduction
Internet Principles, concept of WWW, internet protocols and applications, web browser and web servers, features of Web 2.0

Web Design
Basic web concepts, Client/Server model, concepts of effective web design, web design issues including browser, display resolution, page layout and linking, user centric design, sitemap.

Dynamic Web Pages
The need of dynamic web pages; Comparative studies of different technologies of dynamic page creation.

HTML
Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, meta tags, character entities, frames and frame sets, browser architecture and web site structure. Overview and features of HTML5.

Module II [10L]

Style sheets
Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

Extensible Markup Language (XML)
Introduction, tree, syntax, elements, attributes, validation, viewing. XHTML in brief.

HTTP
Message, request, response, methods, status codes.

Module III [10L]

JavaScript
CGI concepts, data types, variables, operators, conditional statements, array object, date object, string object.

PHP
Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string processing and regular expressions, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.

Module IV [10L]

PHP and MySQL

Open Source Web server, 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.

Network security threats and techniques

Threats: Malicious code, eavesdropping, spoofing, denial of service attacks. Techniques: VPN, password and authentication, firewall, proxies.

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

HTML

1. Web page design using tables, frames, 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.

Paper Name: COMPUTER GRAPHICS					
Paper Code: MCAP2203					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

Introduction
Basics of computer graphics, real world usage of computer graphics, classification of applications, display technologies, raster-scan systems, video controller, random-scan display processor, graphics input devices, graphics software and standard.

Graphics Primitives
Scan converting points.
Scan converting lines – DDA algorithm, Bresenham's algorithm, Midpoint algorithm.
Scan converting circles – Midpoint algorithm.
Scan converting ellipse – Midpoint algorithm.
Fill area primitives–boundary-fill and flood-fill, scan-line polygon fill.

Module II [10L]

Affine Transformation (2D)
2D translation, rotation and scaling, homogeneous coordinates and matrix representation, composite transformations, reflection and shearing.

Viewing and Clipping
Viewing pipeline and coordinates system, window-to-viewport transformation, point clipping.
Line clipping algorithms - Cohen-Sutherland, Midpoint subdivision, Cyrus-Beck algorithms.
Polygon clipping – Sutherland Hodgeman algorithm, Weiler Atherton algorithm.

Module III [10L]

3D Transformation and Viewing
3D translation, rotation and scaling, composite transformations.
Projections - perspective and parallel projections, specifying an arbitrary 3D view.

Curves and Surfaces
Polygon surfaces, curved lines and surfaces, parametric cubic curves – Hermite curves, Bezier curves, Uniform Nonrational B-Splines, Nonuniform Nonrational B-Splines, comparisons of cubic curves, introduction to parametric bicubic surfaces.

Module IV [10L]

Visible Surface Detection
Classification of visible surface detection algorithms, back face detection, z-Buffer algorithm, scan-line algorithms, area subdivision algorithm, octree algorithms, visible-surface ray tracing.

Illumination and Shading
Illumination methods (ambient, diffused and specular reflection), constant and interpolated shading methods (Gouraud, Phong).

Text Books:

1. Computer Graphics C Version - D. Hearn and P. Baker, Pearson Education.
2. Computer Graphics - Xiang and Plastock, Schaum Outline Series.

Reference Books:

1. Procedural Elements of Computer Graphics - Rogers, TMH.
2. Mathematical Elements for Computer Graphics - Rogers, TMH.
3. Computer Graphics - Andries van Dam, James D. Foley, John F. Hughes, Steven K. Feiner, Pearson Education.
4. Introduction to Computer Graphics & Multimedia – Mukhopadhyay and Chattopadhyay, Vikas Publishing House.

Paper Name: GRAPHICS LAB					
Paper Code: MCAP2213					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

The following set of experiments in this Lab will be conducted using C / OPENGL / JAVA in Windows / Linux Environment.

1. Implementation of algorithms for drawing 2D primitives –
   - Line (DDA, Bresenham, Midpoint)
   - Circle (Midpoint)
   - Ellipse (Midpoint).
2. Implementation of region filling algorithms – Boundary fill, flood fill.
3. 2D Geometric transformations –
   - Translation
   - Rotation
   - Scaling
   - Reflection
   - Shear
   - Composite 2D Transformations
4. Implementation of algorithms for line clipping –
   - Cohen-Sutherland
   - Midpoint subdivision
   - Cyrus-Beck
5. Drawing of curves – Cubic Bezier, B-Spline
6. Mini Project with animation

Paper Name: INTELLIGENT SYSTEMS					
Paper Code: MCAP2204					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

Introduction
Introduction to Intelligent Systems: concept, typical problems, practical impact, approaches andlimits.

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

Reference Books:

1. Artificial Intelligence - Elaine Rich and Kelvin Knight, TMH.
2. Artificial Intelligence and Soft Computing Behavioral and Cognitive Modeling of the Human Brain - Amit Konar, CRC Press.
3. Artificial Intelligence: A New Synthesis – N.J. Nilsson, Morgan Kaufmann.
4. Fundamentals of Artificial Intelligence and Expert Systems – V.S. Janakiraman, Macmillan.

Paper Name: PROFESSIONAL ETHICS					
Paper Code: HMTS2201					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**0**	**0**	**3**	**3**

Module I

Human society and the Value System

Values: definition, importance and application.
Formation of Values: The process of Socialization
Self and the integrated personality
Morality, courage, integrity

Types of Values

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----
Individual Level
Societal Level
Cultural Level
Value Crisis management --- Strategies and Case Studies

Module II

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties

Ethics

Standardization
Codification
Acceptance
Application

Types of Ethics

Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work

Computer Ethics

Introduction to computer ethics, Computers used in the social context, Moral and legal issues Professional relationships, conflicting responsibilities, code of ethics and professional conduct, collective responsibilities

Ethics and the Internet
Hacking and Hacker Ethics, Ethics and Criminality, Policy Approaches
Social implications and social values: Technology and Social change, embedded values, enhanced and impeded values, Democratic values in the Internet, Access and the digital divide, free expression.

Privacy
understanding the computers and privacy issue- global perspective proposals for better privacy protection.
Property rights in computer software, philosophical basis of property, proprietary software- legal and philosophical issues.

Whistle Blowing
Facts, contexts, justifications and case studies

Module III

Science and Technology
Science, Technology as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module IV

Environment and Eco- friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment

Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends

Appropriate technology movement by Schumacher and later development Reports of Club of Rome.

Suggested Readings:

1. Human Values – A.N. Tripathi, New Age International, New Delhi.
2. Classical Sociological Theory – G. Ritzer, The McGraw Hill Companies, New York.
3. Postmodern Perspectives on Indian Society - S. L. Doshi, Rawat Publications, New Delhi.
4. Sustainable Development – D.K. Bhatnagar, Cyber Tech Publications, New Delhi.
5. The age of Spiritual Machines – R. Kurzwell, Penguin Books, New Delhi.

6. Social Problems in Modern Urban Society – S.K. Weinberg, Prentice Hall Inc.,USA.
7. Computer Ethics - Johnson,Deborah G., Pearson Education(Singapore) Pte.Ltd.

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

Module I - Professional Growth

- Self Growth: Anger, stress and time management - Theories and application, SWOT analysis.
- Growth and Environment: Impression management, Cross-cultural communication, Employability quotient
- 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 - 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, Policies

Assessment- Project (30 marks)

Module III - Industry specific opportunities

- Industry prospects in India and Beyond
- Industry-specific job opportunities
- Research & Development
- Other opportunities

Assessment---Presentation (30 marks)

Module IV - Working and living happily

- Managing crisis- Organisational and personal crisis, Analysing 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)

Suggested Readings:

1. Basic Managerial Skill for All - E. H. McGrath.SJ, PHI, New Delhi.
2. The Start-up Equation by 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, iUniverse Inc.USA.
5. Influencer: The New Science of Leading Change - Joseph Grenny & Kerey Patterson, McGraw Hill Education , USA.

3rd Year 1st Semester

Paper Name: SYSTEM ADMINISTRATION USING LINUX					
Paper Code: MCAP3150					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [8L]

Introduction to Linux

Basic idea on proprietary, Open source, Free software; Introduction of various Linux variants and comparative study; Basic architecture of Linux system. Linux file system, Boot block, Super block, Inode table, Data blocks, Linux file access, Storage files, Standard directories, LILO, GRUB boot loader; Installation of Linux system, init and run levels.

Module II [11L]

Linux Basics

Login process, Creating user account and group, Getting help. Services and process, Files and file system, Working with files: Reading, Searching, Copying, Moving, Renaming, Deleting, Linking, and Editing files; Disk related commands. Various types of shell available in Linux and their comparisons, Shell programming in bash.

Module III [10L]

System Administration

Common administrative tasks, Identifying administrative files – Configuration and log files, Role of system administrator, Managing user accounts and groups, Creating and mounting file system, Checking and monitoring system performance, File security and permissions, Concepts of Super user; Getting system information. Backup and restore files, Reconfiguration hardware with kudzu, Installing and removing packages in Linux.

Module IV [11 L]

Networking in Linux

Installation and configuration of a simple LAN; Installation and configuration of: Proxy server (Squid), DNS server (BIND), Mail server, Web server (Apache), File server (Samba), DHCP server; Installation and configuration of SSH server and client, FTP server and client. Setting up Linux for firewalling, IP accounting.

Text Books:

1. Linux Administration: A Beginner's Guide - Shah, TMH.
2. LINUX: The Complete Reference - Petersen, TMH.

Reference Books:

1. Red Hat LINUX-Administrator's Guide - Cox, PHI.
2. LINUX Network Administrator's Guide - Kirch, SPD/O' REILLY.
3. Essentials System Administration - Frisch, SPD/O'REILLY.
4. Red Hat Linux Networking & System Administration - Terry Collings & Kurt Wall, Wiley.

Paper Name: SYSTEM ADMINISTRATION LAB					
Paper Code: MCAP3155					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

1. Experiment on packet monitoring software (tcpdump, snort, ethereal)
2. Experiment on using trace route, Ping, Finger, Nmap
3. Server configuration (FTP, SMTP, DNS)
4. NFS configuration
5. Firewall configuration using iptables/ipchains.

Paper Name: ADVANCED JAVA					
Paper Code: MCAP3151					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

GUI Programming: Swing

Swing components and containers, Layout managers, Menu, Event-Driven programming, Event handling mechanism, Event delegation model, Event classes, Event sources, Event listeners, Adapter classes.

Database Programming: JDBC

Introduction to JDBC, JDBC drivers & architecture, Different approaches of connection, Establishing database connection and executing SQL statements, JDBC prepared statements, JDBC data sources.

Module II [10L]

Server Technologies: Servlet

Web application basics, Architecture and challenges of web application, Enterprise Architecture styles: Single tier, 2-tier, 3-tier, n-tier, Relative comparison of the different layers of architectures.

Introduction to servlet, Servlet life cycle, Developing and deploying servlets, Exploring deployment, Descriptor (web.xml), Handling Request and Response, Servlet Chaining, Session tracking and management, Dealing with cookies, Servlet Listeners.

Module III [10L]

Server Technologies: JSP

Comparison between JSP & servlet, Basic JSP architecture, JSP life cycle, JSP tags and expressions, Role of JSP in MVC-2, JSP with database, JSP implicit objects, Tag libraries, JSP Expression Language (EL), Using Custom tag, Exception handling, Session management, Directives.

RMI (Remote Method Invocation)

RMI overview, RMI architecture, Example demonstrating RMI

Module IV [10L]

Enterprise JAVA Beans

Enterprise Bean overview, Types of Enterprise Beans, Advantages of Enterprise Beans, Enterprise Beans life cycle, Working with Session Beans, Statefull vs. Stateless Session Beans, Working with Entity Beans, Message Driven Beans.

Text Books:

1. Advanced Java: Platform How to Program – Harvey M. Deitel, Paul J. Deitel and Sean E. Santry, Prentice Hall.
2. Professional JAVA Server Programming – Allamaraju and Buest, SPD Publication.

Reference Books:

1. Beginning J2EE 1.4 – Ivor Horton, SPD Publication.
2. Advanced Programming for JAVA 2 Platform – Austin and Pawlan, Pearson
3. Internet & Java Programming - Krishnamoorthy and S. Prabhu, New Age Publication
4. Advanced Java: Idioms, Pitfalls, Styles, and Programming Tips – Chris Laffra, Addison Wesley.

Paper Name: ADVANCED JAVA LAB					
Paper Code: MCAP3156					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

Programs related to

- Programming using Swing and Event handling
- JDBC connectivity
- Servlet programming
    - RequestDispatcher
    - sendRedirect
    - GET and POST methods
    - Cookies
    - Sessions
- JSP design
    - page, include, taglib
    - scripting elements
- Remote Method Invocation: programs to provide the mechanism by which the server and the client communicate and pass information back and forth
- JavaBeans
    - useBean action tag
    - getProperty
    - setProperty
    - programs to implement to dynamically generate HTML, XML or other types of documents in response to a web client request

Paper Name: IMAGE PROCESSING					
Paper Code: MCAP3152					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [8L]

Introduction

Overview of image processing, Application area of image processing, Digital image representation, Fundamental steps in image processing, Components of an image processing system. Sampling and quantization. Basic relationship between pixels – Neighbours, Adjacency, Connectivity, Regions, Boundaries and distance measures. Introduction to Fourier transform and Discrete Fourier transform, Properties of 2D Discrete Fourier transform.

Module II [**12L**]

Image Enhancement

Spatial domain image enhancement techniques: Basic intensity transformations – Negative, Log, Power-law, Piecewise linear transformations, Histogram based techniques (histogram equalization, histogram matching). Spatial filtering: Smoothing (linear and non-linear), Sharpening (gradient and Laplacian), Unsharp masking and highboost filtering.

Enhancement in the frequency domain – Basics of filtering in frequency domain, Smoothing and sharpening filters: Ideal, Butterworth, Gaussian. Homomorphic filtering. Selective filtering.

Module III [10L]

Image Restoration

Model of image degradation/restoration process, Noise models, Image restoration in presence of noise only – Spatial filtering, Periodic noise reduction by frequency domain filtering – Bandreject and bandpass filtering. Inverse filtering, Least mean square error filtering, Constrained least squares filtering.

Image Compression

Fundamentals- Redundancy, Measuring image information, Fidelity criteria, Image compression models. Compression methods: Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Predictive coding.

Module IV [10L]

Image Segmentation

Detection of discontinuities, Edge, Line and point detection. Edge linking and boundary detection - Local processing, Global processing via Hough transform. Thresholding – Global, Optimum, Multiple and variable. Region based segmentation: Growing, Splitting and merging.

Image Representation

Representation: Chain codes, Polygonal approximation. Boundary descriptors. Regional descriptors.

Text Books:

1. Digital Image Processing - Gonzalez, Woods, Pearson.
2. Fundamentals of Digital Image Processing - Jain, Pearson.

Reference Books:

1. Principles of Digital Image Processing: Advanced Methods – Burger, Burge, Springer.
2. Digital Image Processing and Analysis - Chanda, Majumder, PHI.
3. Image Processing Principles and Applications - Acharya and Ray, Wiley.
4. Image Processing, Analysis & Machine Vision - Sonka, Hlavac, Boyle, Cengage Learning.

Paper Name: IMAGE PROCESSING LAB					
Paper Code: MCAP3157					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	0	**0**	**4**	**4**	**3**

1. Reading, writing, and displaying images, Conversion from RGB to gray images.
2. Intensity transformations – Image negative, Log, Power-law.
3. Contrast stretching.
4. Image histogram and histogram equalization.
5. Spatial filtering - Smoothing: Linear and non-linear, Sharpening.
6. Fourier transformation of images.
7. Frequency domain filtering.
8. Point detection, Line detection and edge detection.
9. Thresholding – Local, Global, Optimum, Multiple and variable.
10. Region growing, Splitting and merging.

Paper Name: CRYPTOGRAPHY AND NETWORK SECURITY					
Paper Code: MCAP3160					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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, RC5, AES.

Module III [10L]

Asymmetric Key Encryption and Hash Functions

Diffie-Hellman Key Exchange, EIGamal Public Key Encryption, RSA, Elliptic Curve based cryptography, 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.

Text Books:

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

Reference Books:

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

4. Network Security Essentials: Applications and Standards – William Stallings, Pearson Education.

Paper Name: THEORY OF COMPUTING					
Paper Code: MCAP3161					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Module I [12L]

Basic concepts

Types of languages and grammars.

Regular Language and Grammars

Regular language, Regular expression, Regular grammar, Right and Left Linear Grammar, Closure property of regular languages, Pumping lemma, Properties of regular expressions, DFA, NFA and their equivalence. Identifying non regular languages, reduction of number of states, equivalence between regular language and regular grammars.

Module II [10L]

Context free Language and Grammar

Context free language, Context free grammar, Derivation tree, Left most and right most derivation, Parsing and ambiguity, Chomsky and Greibach Normal Form, Pumping Lemma, Properties of CFL including closure property.

Module III [10L]

Pushdown Automata (PDA)

PDA, NPDA as recognizer of CFL.

Context Sensitive Language and Grammars

Context sensitive language, Context sensitive grammars, Matrix grammar, Markov algorithm, L- Systems. Recursive and recursively enumerable languages, Recursive functions, Ackerman's functions, r-recursive functions.

Module IV [8 L]

Turing machine and thesis

Non Deterministic Turing Machine, Universal Turing Machine, Computability and decidability, Undecidable problems: Halting problem of TM, Post correspondence problem, Undecidable problems of CFL, Post systems.

Text Books:

1. An Introduction to Formal Languages and Automata - P. Linz, Narosa Publishing House.
2. Theory of Computer Science - Mishra, Chandrashekharan, PHI.

Reference Books:

1. Introduction of Automata Theory, Languages and Computation, Student Edition - J. E. Hopcroft, J. D. Ullman, Narosa Publishing House.
2. Mathematical Theory of Computation - Zohar Manna, McGraw-Hill.

3. Introduction to Theory of formal Languages and Automata - John C Martin, McGraw-Hill.
4. Theory of Automata, Formal Languages and Computation - S. P. Eigere Xavier, New Age Publishers.

Paper Name: BIG DATA ANALYSIS					
Paper Code: MCAP3162					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [8L]

Introduction

Introduction to Big Data - Characteristics and foundation of Big Data. The need for Big Data analysis. Industry use cases for Big Data.

Statistical concepts: Populations and samples, Statistical modeling, Probability distribution, Fitting a model.

Module II [12L]

Big Data Architecture: Storage and analysis

Introduction of Hadoop and other Apache Big Data Tools, Hadoop cluster, HDFS Operations and HDFS file formats.

Introduction to Hadoop MapReduce Architecture and Programming.

Module III [12L]

Data extraction, transformation and loading mechanism

Introduction to Apache Sqoop - Data import and export mechanism.

Introduction to Hive, HQL and Hive operations.

Introduction to Pig and Pig scripting.

Module IV [8L]

Data visualization

Visualization using Tableau - Design reports, Dashboards etc

Case studies- Project initiation, Conceptualization, Design and environment preparation etc.

Text Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data - EMC Education Services, John Wiley & Sons.

2. Hadoop: The Definitive Guide - Tom White, O'Reilly.

Reference Books:

1. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die - E. Siegel, Wiley.

2. Too Big to Ignore: The Business Case for Big Data - P. Simon, Wiley.

3. Data Smart: Using Data Science to Transform Information into Insight - J. W. Foreman, Wiley.

4. Thinking with Data – M. Shron, O'Reilly.

Paper Name: MOBILE COMPUTING					
Paper Code: MCAP3170					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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.

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

Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE).

Module IV [10L]

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:

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.
3. Mobile Cellular Telecommunications-Analog and Digital Systems – William.C.Y.Lee, Tata Mc Graw Hill Edition.
4. AdHoc Mobile Wireless Networks – C. K. Toh, Pearson Education.

Paper Name: SOFT COMPUTING					
Paper Code: MCAP3171					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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: DATA MINING AND DATA WAREHOUSING					
Paper Code: MCAP3172					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [8L]

Introduction

Overview of Data mining - definition, Data mining functionalities, Issues and challenges, Knowledge discovery process, Data preprocessing, Basic concepts of data mining in a Data warehouse environment.

Association Rules

Market basket analysis, Apriori algorithm, FP – tree growth algorithm, generalized association rule.

Module II [12L]

Data Mining Techniques and Decision Tree

Introduction of data mining techniques, Example of classification problem, Decision tree induction model over fitting pre-pruning, post-pruning, Rule-based classification.

Classification Techniques

Bayesian classification, Neural network, K-nearest neighbor, Support vector machine.

Module III [10L]

Clustering Techniques

Clustering paradigm, Partition algorithms, K-means, Fuzzy C-means, Hierarchical clustering, DBSCAN.

Data Mining Applications

Benefits of data mining, discussion on applications in real time system.

Module IV [10L]

Introduction to Data warehouse

Data warehousing – definitions and characteristics, DBMS schemas for decision support, Data warehouse life cycle, Building a data warehouse, Data Warehousing components and architecture, Warehouse schema, Data marts, OLTP and OLAP systems, OLAP tools.

Designing the Data Warehouse

Data Design - design decisions, Basics of dimensional modeling, Star schemas, Data warehouse design examples.

Text Books:

1. Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Publishers.

2**.** Data Mining: Concepts and Techniques - Jiawei Han and Micheline Kamber, Elsevier.

Reference Books:

1. Data Warehousing – Concepts, Techniques, Products, Application - Prabhu, PHI.
2. Data Mining Techniques - K. Pujari, Universities Press.
3. Data Warehousing, Data Mining and OLAP - Alex Berson and Stephen J Smith, TMH.
4. Data Warehousing in the Real World - Anahory, Pearson Education.

Paper Name: HIGH PERFORMANCE COMPUTING					
Paper Code: MCAP3180					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

Introduction
Evolution of the computing paradigm, Overview of Ubiquitous Computing and its challenges.

Advanced Networking Technologies
NFC, Wireless Networking basics (Bluetooth, WiFi Direct, ZigBee).

Module II [10L]

Location Aware Computing
Personal Assistants, Location tracking, Architecture, Location based service and applications, Location based networks.

Context-aware Computing
Context and Context-aware computing, Issues and challenges, Developing context-aware applications, System architecture.

Module III [10L]

Privacy in Ubiquitous Computing
Understanding Ubicomp Privacy, Technical solutions for Ubicomp Privacy.

Ubiquitous Computing Applications
Wearable Computing, Human activity and emotion sensing, Health Apps, Mobile p2p computing, Smart Homes and Intelligent Buildings.

Module IV [10L]

IoT and Cloud
Definition, Trend, IOT components, IOT applications, Open challenges, Architecture, Energy efficiency, Participatory sensing, New protocols, QoS, QoE.

Text Books:
1. Ubiquitous Computing Fundamentals – John Krumm, CRC Press.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things – David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton,Jerome Henry, CISCO Press.

Reference Books:

1. Pervasive Computing: Technology and Architecture of Mobile Internet Applications – Jochen Burkhardt, Addison-Wesley.
2. Networking Infrastructure for Pervasive Computing: Enabling Technologies and Systems – Debashis Saha, Amitava Mukherjee, Somprakash Bandyopadhyay, Kluwer Academic.
3. Advances in Ubiquitous Networking – (Eds) Sabir, Essaïd, Medromi, Hicham, Sadik, Mohamed, Springer Lecture Notes in Electrical Engineering.
4. Ubiquitous Computing: Smart Devices, Environments and Interactions - Stefan Poslad, Wiley.

Paper Name: PARALLEL AND DISTRIBUTED COMPUTING					
Paper Code: MCAP3181					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

Module I [10L]

Introduction to Parallel Computing

Motivating parallelism, Scope of parallel computing, Pipelining and vector processing.

Parallel Hardware and Parallel Software

Some background - von Neumann architecture, Processes, Multitasking, and Threads, Modifications to the von Neumann model, Virtual memory and instruction-level parallelism, Hardware multithreading.

Parallel hardware – Flynn's taxonomy, Interconnection networks, Cache coherence, Shared-memory versus distributed-memory.

Parallel software – Caveats, Coordinating the processes/threads, Shared-memory, Distributed memory, Programming hybrid systems.

Performance - Speedup and efficiency, Amdahl's law, Scalability, Taking timings, Parallel program design example.

Parallel processing terminology - Data parallelism, Control parallelism.

Parallel Methods for Data Sorting:

Bubble sort - Sequential algorithm, Odd-Even transposition algorithm, Computation decomposition and analysis of information dependencies, Efficiency analysis.

Quick sort - Sequential algorithm, Parallel quick sort algorithm, Parallel computational scheme,

Efficiency analysis.

Module II [10L]

Parallel Program Development

Parallel Methods for Matrix-Vector Multiplication

Problem statement, Sequential algorithm, Data distribution - Row wise data decomposition, Column wise data decomposition and Checkerboard data decomposition. Analysis of information dependencies, Efficiency analysis.

Parallel Methods for Matrix Multiplication

Problem statement, Sequential algorithm, Data distribution - Block-Striped data decomposition, Checkerboard data decomposition (Fox algorithm, Cannon algorithm); Analysis of information dependencies, Efficiency analysis.

Parallel Methods for Solving Linear Equation Systems

Gauss elimination algorithm and Gauss-Seidel algorithm, Problem statement, Sequential algorithm, Analysis of information dependencies, Efficiency analysis.

Module III [10L]

Introduction to Distributed Computing
Why distributed computing, Parallel vs. distributed computing.

Models of Distributed Systems
Synchronous vs asynchronous systems, Inter process communication models (shared memory and message-passing models, agent-based models), complexity measures.

Program Correctness
Safety and liveness properties, atomicity, non-determinism, fairness.

Time and Clocks
Causality and concurrency, physical, logical and vector clocks, clock synchronization.

Distributed Mutual Exclusion
Lamport's algorithm, Ricart-Agrawala's algorithm, Suzuki-Kasami's token-passing algorithm.

Distributed Snapshot and Global States
Consistent snapshots, Chandy-Lamport's distributed snapshot algorithm, Termination detection: Dijkstra-Scholten's algorithm, Distributed deadlock detection.

Module IV [10L]

Distributed Algorithms for Graphs
Routing algorithms (Shortest path, distance-vector, and link-state algorithms), Spanning tree and minimum spanning tree, Graph colouring algorithms.

Faults and Fault-tolerance
Classifications of faults and fault-tolerance, Triple modular redundancy, Sliding window protocols, how TCP works.

Distributed Consensus
The Byzantine Generals problem, Fault-tolerant state machines.

Replicated Data Management
Data consistency models: linearizability, Sequential consistency, Causal consistency, Eventual consistency.

Selected topics from Applications
Peer-to-Peer (P2P) networks, Sensor Networks, Cloud computing.

Text Books:
1. Parallel Computing –Theory and Practice - Michael J. Quinn, McGraw Hill Inc.
2. Distributed Systems – Principles and Paradigms – Tanenbum, Prentice Hall India Learning Private Limited.

Reference Books:

1. Introduction to Parallel Computing – Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Addison Wesley.
2. Introduction to Parallel Processing - Sashi Kumar, PHI.
3. Elements of Distributed Computing - Vijay Garg, John Wiley.
4. Distributed Systems, an Algorithmic Approach - Sukumar Ghosh, CRC Press.

Paper Name: COMPILER DESIGN					
Paper Code: MCAP3182					
Contact hrs. per week	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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 in C - Allen Holub, Prentice Hall.

Reference Books:

1. Algorithms for Compiler Design - O.G. Kakde, Laxmi Publications.
2. Engineering a Compiler, Keith Cooper, Linda Torczon – Morgan Kauffman.
3. Compiler Design - Santanu Chattopadhyay, PHI.
4. The Compiler Design Handbook Optimizations And Machine Code Generation - Y.N. Srikant, Priti Shankar, CRC Press.

Paper Name: ECOMMERCE AND ERP					
Paper Code: MCAP3183					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit Point**
	3	**1**	**0**	**4**	**4**

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. Four C's: (Convergence, Collaborative computing, Content 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: ERP as an 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.