MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Master of Computer Applications (Two Year Programme)
First Semester

680111
Mathematical Foundations
(BSC)

Objective:

- To understand the basic discrete mathematical structures.
- To develop understanding of Boolean mathematics.
- To understand recurrence relations and its usage in computer science.

UNIT-I

Sets Relations and Functions: Sets, Subsets, Power-Sets, Complement, Union and intersection. Demorgan's law Cartesian, products, Relations: relational Matrices, properties of relations, equivalence relation Functions: Injection, Surjection, Bijection, Composition of Functions, Permutations. Cardinality, the characteristic functions and Mathematical induction..

UNIT-II

Lattices :Partial order set, Hasse diagrams, upper bounds, lower bounds, Maximal and minimal element, first and last element ,Lattices, sub lattices , lsotonicity, distributive inequality lattice homomorphism, lattice isomorphism, complete lattice, complemented lattice distribution lattice

UNIT-III

Groups and Fields: Groups: Group axioms-permutation groups; Subgroups, Co-sets, Normal Subgroups, semi groups; Lagrange theorem, fields, minimal polynomials, reducible polynomials, primitive polynomial roots, applications.

UNIT-IV

Graphs: Finite graphs; incidence and degree, isomorphism, subgraphs and union of graphs; Connectedness; Walks paths and circuits Eulerian graphs. Trees properties of trees; pendant vertices in a tree, Center of tree Spanning trees and Cutvertices; Binary tree Matrix representation of graph, Incidence, Adjacency matrices and their properties. Applications of graphs in Computer Science.

UNIT-V

Discrete Numeric function and Recurrence relation: Introduction to discrete numeric functions and generating functions introduction to recurrence relations and recursive

algorithms. Linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions and total solutions.

Books:

1. J.P.Trembley & R.P.Manohar. "Discrete Mathematical Structure with applications to Computer Science

2. Nersingh Deo: Graph Theory. :: C.L. Liu Discrete Mathematics.

3. C.L. Liu: Discrete Mathematics

4. D.K. Jain: Discrete Structures

Course outcomes:

Student would be able to

CO1: Understand the basic concept of set theory, lattices, graph theory, discrete numeric function and algebraic structure.

CO2: Describe basic knowledge of course content and distinguish between them in terms of their applications.

CO3: Implement the course content to related engineering applications and problems faced in real life.

CO4: Apply the concepts of mathematics to the suitable technique for relevant industries and contribution to the society

CO5: Analyze the set theory, lattices, graph theory, discrete numeric function and algebraic structure to examine the real world problem.

CO6: Design analytical skills and interpret applications of engineering beneficial in real time troubleshooting.

680112
Data Structures and Algorithms
(DC-1)

Objective:

- To understand the abstract data types stack, queue, deque, trees, lists etc.
- To be able to design efficient algorithms using various data structures.
- To understand design techniques the time complexity of algorithms.

UNIT-I

Prerequisites: Array, Structure, pointers, pointer to structure, functions, parameterpassing, recursion.

Stack and Queue: contiguous implementations of stack, various operations onstack, various polish notations-infix, prefix, postfix, conversion from one toanother-using stack; evaluation of post and prefix expressions. Contiguousimplementation of queue: Linear queue, its drawback; circular queue; variousoperations on queue; linked implementation of stack and queue- operations

UNIT-II

General List: list and it's contiguous implementation, it's drawback; singly linkedlist-operations on it; doubly linked list-operations on it; circular linked list; linkedlist using arrays.

Time Complexity: models of computation, algorithm analysis, order architecture,time space complexities, computing the average and worst case analysis.

UNIT-III

Trees: definitions-height, depth, order, degree, parent and children relationship etc;Binary Trees- various theorems, complete binary tree, almost complete binary tree;Tree traversals-preorder, inorder and post order traversals, their recursive and nonrecursive implementations; expression tree- evaluation; linked representation ofbinary tree-operations. Threaded binary trees; forests, conversion of forest into tree.Heap-definition.Miscellaneous features Basic idea of AVL tree- definition, insertion

& deletion operations; basic idea of B-tree- definition, order, degree, insertion &deletion operations;B-tree- definitions, comparison with B-tree; basic idea of string processing.

UNIT-IV

Searching, Hashing and Sorting: requirements of a search algorithm; sequentialsearch, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaning; Internal sorting- Bubblesort, selection sort, insertion sort, quick sort, merge sort on linked and contiguouslist, shell sort, heap sort, tree sort.

UNIT-V

Graphs: Overview, related definitions: graph representations- adjacency matrix,adjacency lists, adjacency multilist; traversal schemes- depth first search, breadthfirst search; Minimum spanning tree; shortest path algorithm; kruskal& dijkstraalgorithm.

Books:

1. Theory and Problems of Data Structures, Seymour Lipschutz,Schaum'SOutline Series, McGraw Hill.
2. Kruse R.L. Data Structures and Program Design in C; PHI
3. TennenBaum A.M. & others: Data Structures using C & C++; PHI
4. Horowitz & Sawhaney: Fundamentals of Data Structures, GalgotiaPublishers.
5. Ullman "Analysis and Design of Algorithm" TMH
6. Goodman "Introduction to the Design & Analysis of Algorithms, TMH-2002.
7. Sara Basse, A. V. Gelder, " Computer Algorithms," Addison Wesley

8. T. H. Cormen, Leiserson ,Rivest and Stein, "Introduction of Computeralgorithm," PHI

Course Outcomes:

Student would be able to

CO1: **Discuss** the basics of data structures.
CO2: **Design** various linear and non-linear data structures available
CO3: **Describe** several sorting algorithms including quick sort, merge sort and heapsort.
CO4: **Organize** some graph algorithms such as shortest path and minimum spanningtree
CO5: **Analyze** the complexity of various algorithms for different data structures
CO6: **Evaluate** different data structure techniques for real world problems.

680113
Database Management Systems
(DC-2)

Objectives:

- To describe key concepts, issues, and operational terminology
- To understand the relationships of key components behind concepts such as hardware, networks, data storage, operating systems, and software programs.
- To normalize any problem using 1^{st},2^{nd},3^{rd},4^{th},5^{th} normal form

UNIT-I

Introduction: Advantage of DBMS approach, various view of data, data independence, schema and sub-schema, primary concepts of data models, Database languages, transaction management, Database administrator and users, data dictionary, overall system architecture.

ER model: basic concepts, design issues, mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables.

UNIT-II

Domains, Relations and Keys: domains, relations, kind of relations, relational database, various types of keys, candidate, primary, alternate and foreign keys.

Relational Algebra & SQL: The structure, relational algebra with extended with extended operations, modifications of Database, idea of relational calculus, basic structure of SQL, set operations, aggregate functions, null values, nested sub queries, derived relations, views, modification of Database, join relations, DDL in SQL.

UNIT-III

Functional Dependencies and Normalization: basic definitions, trivial and non trivial dependencies, closure set of dependencies and of attributes, irreducible set of dependencies, introduction to normalization, non loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, Join dependency and fifth normal form.

UNIT-IV

Transaction, concurrency and Recovery: basic concepts, ACID properties, Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, basic idea of concurrency control, basic idea of deadlock, failure classification, storage structure types, stable storage implementation, data access, recovery and atomicity- log based recovery, deferred Database modification, immediate Database modification, checkpoints.

UNIT-V

Distributed Database: basic idea, distributed data storage, data replication, data fragmentation- horizontal vertical and mixed fragmentation

Storage structure and file organizations: overview of physical storage media, magnetic disks-performance and optimizations, basic idea of RAID, file organizations, organization of records in files, basic concepts of indexing, ordered indices, basic idea of B-tree and B+-tree organization.

Books:

1. Database System Concepts – A Silberschatz, H.F Korth, Sudersan, MGH Publication.
2. An introduction to Database Systems – C.J Date 6^{th} ed.
3. Fundamentals of Database systems – L elmasri & Navathe III ed.

4. An introduction to Database systems – B.C. Desai.

Course Outcomes:

Student would be able to

CO1: **Differentiate** database systems from file systems by enumerating the features provided by database systems and execute various SQL queries

CO2: **Define** the terminology, features, classifications, and characteristics embodied in database systems.

CO3: **Design** principles for logical design of databases, including the E-R method and improve the database design by normalization.

CO4: **Evaluate** the principles of storage structure and recovery management.

CO5: **Identify** the issues of transaction processing and concurrency control.

CO6: **Analyze** an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary, file and page organizations, indexing methods including B tree, and hashing. .

680114
Operating Systems
(DC-3)

Objectives:

- To learn the fundamentals of Operating Systems.
- To understand the intrinsic of basic services provided by the operating system like process management, processor management, memory management, devioce management and information management..
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

UNIT-I

Introduction: Evolution of operating systems, Types of operating systems, Different views of operating system, operating system concepts and structure.

Processes: The process concept, systems programmer's view of processes, operating system services for processes management, scheduling algorithms, Performance evaluation.

UNIT-II

Memory Management: Memory management without swapping or paging , swapping , virtual memory, page replacement algorithms, modeling paging algorithms, design issues for paging system, segmentation.

UNIT-III

Interprocess communication and synchronization: The need for interprocess synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problems in concurrent programming, critical region and conditional critical region, monitors messages.

UNIT-IV

Deadlocks: Deadlock prevention, deadlock avoidance.

File system: File systems, directories, file system implementation security and protection mechanism.

Input/Output: Principles of I/O Hardware: I/O devices, device controllers, direct memory access, Principles of I/O software: Goals interrupt handlers, device drivers, and device independent I/O software, User space I/O software.

UNIT-V

Disks: Disk hardware, scheduling algorithms, Error handling, track-at-a time caching RAM disk.

Clocks: clock hardware, memory mapped terminals, I/O software

Distributed file system: Design, implementation and trends.

Performance measurement: monitoring and evaluation introduction, important trends affecting performance issues, why performance monitoring and evaluation are needed, performance measures, evaluation techniques, bottlenecks and saturation, feedback loops.

Case studies: MS-DOS, MS Windows and Linux(Unix) Operating System.

Books:

1. Deitel "An introduction to operating systems". Addison Wesley Publishing Company 1984.
2. Milenkovic M. "Operating Systems – concepts and design" McGraw Hill International Edition – Computer science series 1992.

3. Peterson, Silberschatz. "Operating System Concepts". Addison Wesely Publishing Company, 1989.
4. Tanenbaum A.S. "Modern Operating System" Prentice Hall of India Pvt Ltd 1995.

Course Outcomes:

Student would be able to

CO1: **Evaluate** different structures for operating systems

CO2: **Analyze** theory and implementation of: processes, resource control (concurrency etc.)

CO3: **Distinguish** system calls for managing processes, memory and the file system.

CO4: **Demonstrate** the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO5: **Apply** the various resource management techniques for distributed systems

CO6: **Discover** the different features of real time and mobile operating systems

680115
Management Functions and Oral & Written Communication
(BM-1)

Course Objectives:

- The course intends to build the required spoken and written skills of the students so as to communicate effectively in real-life situations like starting a talk and be comfortable using English language.
- It aims at teaching students to appreciate English language through the study of scientific, creative, and academic text.
- The course is designed to acquaint students with structure of English language used in literature, functional varieties, figurative language, and verbal concomitance.
- The students are expected to enrich their knowledge of language, culture, and ethics through this course.

Unit: 1 Communication

Communication: Meaning, Nature, Process, Elements of Communication, Importance of Effective Communication, Communication Situation, Barriers to Communication, Johari Window.

Verbal and Nonverbal Communication, Organisational Communication, Formal and informal communication, Grapevine Communication.

Unit: 2 Listening & Speaking

Listening & Speaking, Speak, Read and Write, Improving Communication Skills. Speaking: Presentation: Conducting, Visual and Audio-visual aids. Group Discussion. Meetings. Interview. Telephonic Conversations, Seminar, Debates, and Public Speaking.

Unit: 3 Reading

Reading: Essentials of reading, Skimming and Scanning passages. Reading stories, articles, prose and fiction. [with reference to following **three** Short Stories:

1. R K Narayan — *An Astrologer's Day*
2. Ernest Hemingway — *The Old Man at the Bridge*
3. James Joyce – *Araby*

Unit: 4 Writing

Writing: Mechanics of Writing. Paragraph Writing. Letters: Essentials of Writing Letters, Types of Official Letters, Letters of complaints enquiry, order, and Informative.

Applications: Job Applications, Drafting Biodata.

Writing Reports: Mechanics of Report Writing, Types of Report, Technical Report, Organising a report Précis Writing,

Unit 5: Management Concept:

a. Meaning Characteristics and Importance of management, Difference and Relationship between Organization, Management, and Administration. Contribution of Henry Fayol and F W Taylor. Scientific Management, Principles of Management, Process of Management, Functions of Management, Levels of Management.

b. Motivation, and theories of Motivation by Maslow, Herzberg, McClelland, Ash.

c. Decision making: Steps of decision making.

Reference Books:

- *Communication Skills for Engineers – Pearson Education.*
- *Understanding Human Communication by Rodman and Adler published by OUP.*
- *Technical Communication – Oxford University Press*
- *Study Listening, Speaking Reading, Writing a series by Cambridge University Press.*
- *The Practice of Management Peter Drucker Harper and Row*

- *Essentials of Management: Koontz, Prentice Hall of India*
- *Principles of Management by Stephen P Robbins et. al.*

Course Outcomes: ***After successful completion of the course student will be able to***

CO1 → Speak effectively and appropriately in a public forum to a variety of audiences and purposes. (LOT1)

CO2 → Prepare presentations and arguments within the Engineering Profession effectively. (LOT2)

CO3 → Demonstrate comprehension of traditions in language as well as its social, cultural, and historical context. (LOT3)

CO4 → Relate management principles, processes and procedures in consideration of their effort on individual actions. (LOT3)

CO5 → Infer day to day issues supplemented with interpretative skills achieved through management and communication. (HOT 5)

CO6 → Implement professional work habits necessary for effective collaboration and cooperation with others. (HOT4)

Object Oriented Programming Lab
(DLC-1)

Data Types; Constant & Variable; Operators & expressions. Priority & associatively of operators.

Control Constructs- if-else, for while, do-while; Case statement; Arrays; Formatted & unformatted I/O; Type modifiers & storage classes; Ternary operator; Type conversion & type casting; Special constructs-Break, continue, exit (), goto & labels;

Functions; Arguments; Return Value; Parameter passing- call by value, call by reference; Return statement; Scope, visibility and life-time rules for various types of variable, static variable; Calling a function; Recursion – basics, comparison with iteration, tail recursion, when to avoid recursion, examples.

Overview of object oriented programming, evolution, features, comparison with procedural languages, applications, advantages. C++ basics, data types, Operators, loops and decisions, structures and functions, references.

Object model, OOD, OOA, abstraction, encapsulation, modularity, hierarchy , state, behavior and relationship among objects. Object oriented design, identifying classes and objects, object diagrams.

Course outcomes:

Student would be able to

CO1: Adhere to object oriented programming constructs.

CO2: Implement inheritance, polymorphism, encapsulation, abstraction.
CO3: Modify existing codes and classes as per the requirement of software development.
CO4: Construct programming solutions to a broad range of query problems
CO5: Develops object oriented application system as part of a team in industry.
CO6: Design the classes and constructs for real time software as per societal needs.

Database Management Laboratory
(DLC-2)

Basic structure of SQL, set operations, aggregate functions, null values, nested sub queries, derived relations, views, modification of Database, join relations, DDL in SQL. Creation of a database and writing SQL queries to retrieve information from the database. Performing insertion, deletion, modifying, altering, updating and viewing records based on conditions. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Creation of Views, Creating an Employee database to set various constraints. Creating relationships between the databases. Case Study using real life database applications.

Course outcomes:

Student would be able to

CO1: **Design** database application system as part of a team.
CO2: **Solve** queries using SQL
CO3: **Design** an information model expressed in the form of an entity relation diagram
CO4: **Adapt** normalization theory for a database.
CO5: **Implement** data definition language for the schema using a DBMS
CO6: **Construct** database application system solutions to a broad range of query problems.