



# SARDAR PATEL UNIVERSITY, BALAGHAT

## School of Computer Application Syllabus (under NEP with Option 2)

Course: Master of Computer Applications (MCA)

Semester: I

Branch: Computer Science and Application

w.e.f. Academic Session: 2025-26

### Subject: Information Technology (MCA101)

#### Course Objectives

This course aims to:

- Introduce the foundational concepts and scope of Information Technology.
- Familiarize students with computer hardware, software, and operating systems.
- Provide insights into networking principles and internet technologies.
- Develop proficiency in productivity tools and basic database operations.
- Explore emerging trends and ethical issues in the IT domain.

#### Course Outcomes

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

**CO1:** Understand the evolution, scope, and applications of Information Technology.

**CO2:** Identify and explain the components of computer systems and software.

**CO3:** Demonstrate knowledge of networking concepts and internet technologies.

**CO4:** Use productivity tools and perform basic database operations.

**CO5:** Analyze emerging technologies and discuss ethical and legal aspects of IT.

#### UNIT-I: Fundamentals of Information Technology

Definition and scope of Information Technology. Evolution and history of computing. Components of IT: Hardware, Software, People ware. Classification of computers: Micro, Mini, Mainframe, Supercomputers. Applications of IT in business, education, healthcare, governance. Role of IT in digital transformation and smart systems.

#### UNIT-II: Computer Hardware and Software

Input and Output devices: Keyboard, Mouse, Scanner, Printer, Monitor. Memory hierarchy: Primary (RAM, ROM), Secondary (HDD, SSD), Cache, Virtual Memory. Storage devices: Magnetic, Optical, Solid-State. System Software: Operating Systems (Windows, Linux, macOS), Utilities, Device Drivers. Application Software: Office Suites, Multimedia, Business Applications. Software licensing: Freeware, Shareware, Open-source, Proprietary. Introduction to programming languages and compilers.

#### UNIT-III: Networking and Internet Technologies

Basics of computer networks: LAN, WAN, MAN, PAN. Network topologies: Bus, Star, Ring, Mesh, Hybrid. Communication protocols: TCP/IP, HTTP, FTP, SMTP, POP3. Internet services: Browsers, Search engines, Email, Cloud services. IP addressing: IPv4, IPv6, DNS, domain names. Cybersecurity: Threats (malware, phishing, ransomware), firewalls, antivirus, encryption. Safe browsing practices and digital footprint.

#### UNIT-IV: Productivity Tools and Database Basics

Word processing tools: MS Word/LibreOffice Writer – formatting, templates, mail merge. Spreadsheet tools: MS Excel/LibreOffice Calc – formulas, charts, pivot tables. Presentation tools: MS PowerPoint/LibreOffice Impress – slide design, transitions, animations. Introduction to databases: DBMS vs RDBMS, data models. Basic SQL operations: SELECT, INSERT, UPDATE, DELETE, Data types, tables, keys, relationships, normalization. Introduction to MS Access or MySQL.

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### UNIT-V: Emerging Trends and IT Ethics

Artificial Intelligence and Machine Learning: concepts and applications. Internet of Things (IoT): smart devices, sensors, connectivity. Cloud Computing: models (IaaS, PaaS, SaaS), benefits, challenges, Big Data and Data Analytics: volume, velocity, variety, tools. Virtual Reality (VR) and Augmented Reality (AR): immersive technologies. Green Computing: energy efficiency, e-waste management. IT laws and ethics: Cybercrime, Data Protection, Intellectual Property Rights. Ethical issues: Privacy, Digital Divide, Net Neutrality, Social Media Ethics.

### Text Books

Title	Author	Publisher
Fundamentals of Information Technology	Alexis Leon & Mathews Leon	Vikas Publishing House
Introduction to Information Technology	V. Rajaraman	PHI Learning
Computer Fundamentals	P.K. Sinha	BPB Publications

### Reference Books

Title	Author	Publisher
Information Technology: Principles, Practices and Opportunities	Dinesh Sharma	Tata McGraw-Hill
Computer Networks	Andrew S. Tanenbaum	Pearson Education
Database System Concepts	Abraham Silberschatz, Henry F. Korth	McGraw-Hill
Cybersecurity Essentials	Charles J. Brooks	Pearson Education
Cloud Computing: Principles and Paradigms	Rajkumar Buyya	Wiley India



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## Subject: Discrete Mathematics (MCA102)

### Course Objectives

By the end of this course, students will:

- Understand the fundamental principles of logic, set theory, and relations.
- Apply mathematical reasoning to solve problems in computer science.
- Learn basic combinatorics, graph theory, and algebraic structures.
- Develop skills in formal proof techniques and algorithmic thinking.
- Use discrete structures to model and analyze computational systems.

### Course Outcomes

Upon successful completion, students will be able to:

- Use propositional and predicate logic for formal reasoning.
- Apply set theory, relations, and functions in problem-solving.
- Solve counting problems using permutations, combinations, and recurrence relations.
- Analyze graphs and trees for data structures and algorithms.
- Understand algebraic structures like groups and semi groups in computing contexts.

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### UNIT-I: Mathematical Logic and Proof Techniques

Propositions and logical connectives. Truth tables and tautologies. Logical equivalence and implications. Predicate logic and quantifiers. Methods of proof: direct, indirect, contradiction, induction.

**Focus:** Building reasoning skills and understanding formal logic used in programming and algorithms.

### UNIT-II: Set Theory, Relations, and Functions

Sets and operations: union, intersection, difference, complement. Venn diagrams and identities. Relations: properties (reflexive, symmetric, transitive), equivalence relations. Functions: types, composition, inverse. Mathematical induction and recursive definitions.

**Focus:** Modeling data and relationships in computing systems.

### UNIT-III: Combinatory and Recurrence Relations

Basic counting principles: addition and multiplication rules. Permutations and combinations. Pigeonhole principle. Inclusion-exclusion principle. Recurrence relations and solving techniques.

**Focus:** Solving problems related to data arrangement, algorithm analysis, and complexity.

### UNIT-IV: Graph Theory and Trees

Graphs: definitions, types, representations. Degree, paths, cycles, connectivity. Euler and Hamiltonian paths. Trees: properties, traversal methods. Applications in computer networks and data structures.

**Focus:** Understanding structures used in algorithms, databases, and networking.



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#### UNIT-V: Algebraic Structures and Applications

Introduction to algebraic systems: semi groups, monoids, groups. Properties and examples. Homomorphism and isomorphism. Applications in automata theory and cryptography.

**Focus:** Exploring abstract structures that support formal computation and security.

#### Textbooks and Reference Books

1. **Discrete Mathematics and Its Applications** by Kenneth H. Rosen  
*Publisher: McGraw-Hill Education*
2. **Elements of Discrete Mathematics** by C.L. Liu.  
*Publisher: McGraw-Hill Education*

#### Reference Books

1. **Discrete Mathematical Structures** by Bernard Kolman, Robert C. Busby, Sharon Cutler Ross.  
*Publisher: Pearson Education.*
2. **Discrete Mathematics** by Seymour Lipschutz and Marc Lipson (Schaum's Outline Series)  
*Publisher: McGraw-Hill Education*
3. **Foundations of Discrete Mathematics** by K.D. Joshi.  
*Publisher: Wiley Eastern Limited*



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### Subject: Advance Programming in C (MCA103P)

#### Course Objectives

This course aims to:

- Strengthen foundational programming skills using the C language.
- Develop proficiency in modular programming, memory management, and data structures.
- Introduce advanced concepts such as file handling, dynamic memory allocation, and linked lists.
- Enhance problem-solving abilities through structured and efficient coding practices.
- Prepare students for system-level programming and competitive coding environments.

#### Course Outcomes

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

CO1: Apply advanced control structures and modular programming techniques in C.

CO2: Implement arrays, strings, and functions for structured problem solving.

CO3: Utilize pointers and dynamic memory allocation for efficient memory management.

CO4: Design and manipulate user-defined data structures such as structures and unions.

CO5: Perform file operations and implement linked lists for data organization and processing.

#### UNIT-I: Advanced Control Structures and Functions

Recap of basic syntax and control statements. Nested loops, switch-case, and goto. Function declaration, definition, and calling. Function recursion and stack behavior. Storage classes: auto, static, extern, register. Scope and lifetime of variables.

#### UNIT-II: Arrays, Strings, and Memory Concepts

One-dimensional and multi-dimensional arrays. String handling functions and operations. Array of strings and string manipulation. Memory representation of arrays and strings. Introduction to pointers and pointer arithmetic.

#### UNIT-III: Pointers and Dynamic Memory Allocation

Pointer to variables, arrays, and functions. Pointer expressions and pointer to pointer. Dynamic memory allocation: malloc, calloc, realloc, free. Dangling pointers and memory leaks. Pointer-based function arguments and return types.

#### UNIT-IV: Structures, Unions, and Enumerations

Defining and using structures. Array of structures and nested structures. Self-referential structures. Unions and memory sharing. Enumerated data types. Typedef and bit-fields.

#### UNIT-V: File Handling and Linked Lists

File operations: fopen, fclose, fread, fwrite, fprintf, fscanf. File modes and error handling. Sequential and random access files. Introduction to linked lists: singly, doubly, circular. Operations on linked lists: insertion, deletion, traversal. Real-world applications of linked lists.



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#### Text Books

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Programming in ANSI C	E. Balagurusamy	McGraw-Hill Education
Let Us C	Yashavant Kanetkar	BPB Publications
The C Programming Language	Brian W. Kernighan & Dennis M. Ritchie	Prentice Hall

#### Reference Books

Title	Author	Publisher
C Programming: A Modern Approach	K.N. King	W. W. Norton & Company
Expert C Programming: Deep C Secrets	Peter van der Linden	Pearson Education
Data Structures Using C	Reema Thareja	Oxford University Press
Pointers in C	Yashavant Kanetkar	BPB Publications

#### Practical List

1. Program to check whether a number is prime using loops.
2. Program to generate Fibonacci series using recursion.
3. Program to demonstrate use of different storage classes.
4. Program to calculate factorial using both iteration and recursion.
5. Program to implement a calculator using switch-case.
6. Program to sort an array using bubble sort.
7. Program to perform matrix addition and multiplication.
8. Program to reverse a string without using built-in functions.
9. Program to count vowels, consonants, digits, and spaces in a string.
10. Program to demonstrate pointer arithmetic with arrays.
11. Program to swap two numbers using pointers.
12. Program to dynamically allocate memory for an array and compute its average.
13. Program to demonstrate use of malloc, calloc, realloc, and free.
14. Program to pass a pointer to a function and modify the original value.
15. Program to create a dynamic 2D array and perform matrix operations.
16. Program to store and display student information using structures.
17. Program to demonstrate nested structures and array of structures.
18. Program to compare memory usage between structure and union.
19. Program to use typedef and enum for defining custom types.
20. Program to implement a simple employee database using structures.



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## Subject: Advance DBMS using Oracle (MCA104P)

### Course Objectives

By the end of this course, students will:

- Understand the architecture and components of database systems.
- Gain hands-on experience with Oracle SQL and PL/SQL for data manipulation and control.
- Learn to design normalized relational schemas and implement them in Oracle.
- Explore advanced database programming concepts including cursors and triggers.
- Develop skills in database administration, performance tuning, and security.

### Course Outcomes

Upon successful completion, students will be able to:

- Design and implement relational databases using Oracle tools.
- Write efficient SQL queries and PL/SQL programs including procedures, functions, cursors, and triggers.
- Normalize data models and enforce integrity constraints.
- Manage transactions, indexing, and user privileges in Oracle.
- Apply Oracle features for real-world database applications and administration.

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### UNIT-I: Database Design and Normalization

ER modeling and schema design. Mapping ER models to relational schemas. Normalization: 1NF, 2NF, 3NF, BCNF. Integrity constraints and referential integrity.

#### Practical Focus:

Designing ER diagrams using Oracle tools. Normalizing sample datasets. Implementing relational schemas from ER models.

### UNIT-II: Introduction to DBMS and Oracle Architecture

DBMS concepts and architecture. Data models: hierarchical, network, relational. Oracle database architecture and components. Oracle installation and environment setup. SQL\*Plus and Oracle SQL Developer interface.

#### Practical Focus:

Installing Oracle and configuring environment. Creating basic tables and exploring Oracle tools.

### UNIT-III: SQL – Data Definition and Manipulation

SQL syntax and structure. DDL: CREATE, ALTER, DROP. DML: INSERT, UPDATE, DELETE. Constraints: PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK. SELECT queries with filtering, sorting, joins, and subqueries.

#### Practical Focus:

Writing SQL scripts for table creation and data manipulation. Implementing constraints and relationships. Complex SELECT queries with joins and nested queries.



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### UNIT-IV: PL/SQL Programming with Cursors and Triggers

Introduction to PL/SQL blocks. Variables, control structures, loops. Cursors: implicit and explicit. Exception handling. Triggers: BEFORE, AFTER, INSTEAD OF. Stored procedures and functions. **Practical Focus:** Writing PL/SQL programs using cursors. Creating and testing triggers for data validation and automation. Developing procedures and functions for modular programming.

### UNIT-V: Advanced Oracle Features and Administration

Transactions and concurrency control. Indexing and performance optimization. Backup and recovery techniques. User roles, privileges, and security. Oracle Data Dictionary and system views.

#### Practical Focus:

Managing transactions and locks. Creating indexes and analyzing query performance. Administering users and roles. Exploring Oracle system views and metadata.

### Textbooks and Reference Books

1. **Database System Concepts** by Abraham Silberschatz, Henry F. Korth, S. Sudarshan.  
*Publisher: McGraw-Hill Education.*
2. **Oracle Database 12c SQL** by Jason Price.  
*Publisher: Oracle Press / McGraw-Hill.*
3. **Oracle PL/SQL Programming** by Steven Feuerstein and Bill Pribyl.  
*Publisher: O'Reilly Media.*

### Reference Books

1. **Fundamentals of Database Systems** by Ramez Elmasri and Shamkant B. Navathe.  
*Publisher: Pearson Education.*
2. **Learning Oracle SQL and PL/SQL** by Rajshekhar Sunderraman.  
*Publisher: Pearson Education.*
3. **Oracle Database 12c: The Complete Reference** by Bob Bryla and Kevin Loney.  
*Publisher: Oracle Press / McGraw-Hill*

### Practical List: DBMS Using Oracle

#### SQL Basics and Table Operations

1. **Create a table for employee details** with appropriate data types and constraints.
2. **Insert sample records** into the employee table and retrieve them using SELECT queries.
3. **Update and delete records** using WHERE clause conditions.
4. **Implement constraints** (PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK) on multiple tables.
5. **Perform JOIN operations** (INNER, LEFT, RIGHT) between employee and department tables.
6. **Write subqueries** to find employees with salaries above the department average.
7. **Use aggregate functions** (SUM, AVG, COUNT, MAX, MIN) with GROUP BY and HAVING clauses.
8. **Create views** to display selected columns from multiple tables.

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### PL/SQL Programming

9. Write a PL/SQL block to display employee details using variables and control structures.
10. Create and use an explicit cursor to fetch and display employee records.
11. Write a PL/SQL program to update salaries using a cursor and conditional logic.
12. Handle exceptions in PL/SQL for division by zero or invalid data.
13. Create a stored procedure to insert a new employee record.
14. Create a function to calculate annual salary based on monthly salary input.
15. Create a package that includes procedures and functions for employee operations.

### Triggers and Advanced Features

16. Create a BEFORE INSERT trigger to validate employee age before adding a record.
17. Create an AFTER UPDATE trigger to log changes in salary to an audit table.
18. Design and normalize a student-course enrollment schema up to 3NF.
19. Create indexes on frequently queried columns and analyze performance.
20. Manage user roles and privileges by creating users and assigning access rights.

