DATABASE MANAGEMENT SYSTEMS (DBMS)

INTRODUCTION

A Database Management System (DBMS) is software used to store, retrieve, and manage data efficiently. It ensures data integrity, security, and concurrent access. Examples include MySQL, Oracle, SQL Server, and PostgreSQL.

DBMS acts as an interface between the user and the database, helping to organize and manipulate large volumes of data effectively.

MODIFIED SYLLABUS (5 UNITS)

UNIT I – INTRODUCTION TO DATABASES

Data and Information – Purpose of Database Systems – Database System Architecture – Data Abstraction – Data Models – Relational Model – Entity Relationship (ER) Model – Keys – Relational Algebra.

UNIT II – STRUCTURED QUERY LANGUAGE (SQL)

SQL Fundamentals – DDL, DML, DCL, TCL Commands – Built-in Functions – Joins, Subqueries, Views – Constraints – Indexing – PL/SQL Basics.

UNIT III – DATABASE DESIGN AND NORMALIZATION

ER-to-Relational Mapping – Functional Dependencies – Anomalies – Normal Forms (1NF to BCNF) – Denormalization – Schema Refinement – Integrity Constraints.

UNIT IV – TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL

Transaction Concepts – Properties of Transactions (ACID) – Concurrency Control Techniques – Lock-Based Protocols – Deadlock Handling – Recovery System – Log-based Recovery.

UNIT V – EMERGING DATABASE TECHNOLOGIES

Distributed Databases – Cloud Databases – NoSQL Concepts – Object-Oriented Databases – Big Data Overview – Database Security and Backup Mechanisms.

UNIT I – INTRODUCTION TO DATABASES

A database is a collection of interrelated data organized for efficient access and management.

Characteristics of DBMS:

• Data Independence

• Efficient Data Access

• Concurrent Access Control

• Recovery and Security

Database Models:

• Hierarchical Model – Tree-like structure.

• Network Model – Many-to-many relationships.

• Relational Model – Tables (relations) represent data using rows and columns.

ER Model:

• Entity – Object of interest.

• Attributes – Properties of entity.

• Relationships – Association among entities.

UNIT II – STRUCTURED QUERY LANGUAGE (SQL)

SQL is a standard language for managing relational databases.

Categories of SQL Commands:

• DDL – CREATE, ALTER, DROP

• DML – INSERT, UPDATE, DELETE

• DCL – GRANT, REVOKE

• TCL – COMMIT, ROLLBACK

Example:

CREATE TABLE Employee(EID INT PRIMARY KEY, Name VARCHAR(30), Salary FLOAT);

SELECT * FROM Employee WHERE Salary > 50000;

UNIT III – DATABASE DESIGN AND NORMALIZATION

Normalization is a process of organizing data to minimize redundancy and improve data integrity.

• 1NF – Removes repeating groups.

• 2NF – Removes partial dependencies.

• 3NF – Removes transitive dependencies.

• BCNF – Handles anomalies beyond 3NF.

Functional Dependency: A $\rightarrow$ B means attribute B depends on A.

Example: EmpID $\rightarrow$ EmpName, EmpDept

UNIT IV – TRANSACTION MANAGEMENT

A transaction is a logical unit of work that must be executed fully or not at all.

ACID Properties:

• Atomicity – All or nothing.

• Consistency – Database remains consistent.

• Isolation – Transactions execute independently.

• Durability – Results are permanent after commit.

Concurrency Control prevents conflicts using locks and timestamps.

UNIT V – EMERGING DATABASE TECHNOLOGIES

Modern applications use advanced database concepts:

• Distributed Database – Data spread across multiple systems.

• Cloud Database – Managed on cloud platforms (AWS, Azure).

• NoSQL – Non-relational databases like MongoDB, Cassandra.

• Object-Oriented Database – Stores objects directly.

• Big Data – Handles massive, complex datasets.

• Database Security – Prevents unauthorized access and ensures backup.

SUMMARY

DBMS provides efficient data management through relational structures and normalization. SQL enables manipulation and retrieval of data. Transaction management ensures consistency, while emerging technologies make databases scalable and secure.

QUESTION BANK

PART B – 2 Marks

1. Define DBMS.

2. List the advantages of DBMS over file system.

3. What is an ER diagram?

4. Define normalization.

5. What are ACID properties?

PART C – 14 Marks

1. Explain the architecture of DBMS with a neat diagram.

2. Describe the types of keys and their uses in database design.

3. Explain normalization up to BCNF with examples.

4. Discuss various SQL commands with syntax and examples.

5. Explain transaction states and concurrency control techniques.

PART D – 10 Marks

1. Compare hierarchical, network, and relational database models.

2. Discuss emerging database technologies with examples.