DATABASE SYSTEMS SYLLABUS

Module 1: Database Systems Concepts and Architecture

- Introduction to database systems and their necessity
- Characteristics and advantages of the database approach
- Roles in database management: Database Administrator
- Classification of DBMS and instances
- Three-Schema Architecture
- Centralized and client/server architectures for DBMS
- Database models, schemas, and system environment

Module 2: Relational Model and E-R Modeling

- Relational model: Candidate keys, primary keys, foreign keys
- Integrity constraints and handling nulls
- Entity-relationship (ER) model: Attributes, relationships, and structural constraints
- Mapping ER model to relational schema
- Extended ER model: Generalization, specialization, and aggregation

Module 3: Relational Database Design

- Database design and schema refinement
- Functional dependencies and axioms on functional dependencies
- Normalization: First, second, and third normal forms
- Boyce-Codd normal form (BCNF), multi-valued dependencies, and fourth normal form
- Join dependency and fifth normal form

Module 4: Physical Database Design and Query Processing

- File organization and indexing: Single-level, multi-level, dynamic multi-level indexing
- B+ Tree indexing and hashing techniques: Static and dynamic hashing
- Relational algebra and translating SQL queries into relational algebra
- Query processing and optimization: Algebraic and heuristic query optimization, join query optimization using indexing and hashing
- Tuple relational calculus

Module 5: Transaction Processing and Recovery

- Introduction to transaction processing: ACID properties, transaction states
- Serial and serializable schedules, schedules based on recoverability and serializability
- Conflict serializability
- Recovery concepts: Log-based recovery protocols, recovery techniques based on deferred and immediate updates
- Shadow paging algorithm

Module 6: Concurrency Control in Transaction Processing

- Concurrent transaction processing and the lost update problem
- Concurrency control techniques: Timestamp-based protocols, Thomas Write Rule, lock-based protocols, lock compatibility matrix
- Two-phase locking protocol, lock conversions
- Graph-based concurrency control protocols
- Deadlock handling techniques: Detection and prevention methods, multi-granularity locking

Module 7: NoSQL Database Management

- Introduction to NoSQL databases
- Need for NoSQL and the CAP Theorem
- Different types of NoSQL databases