

SEMESTER I

Course Name: Database Management Theory

No. of credits: 05

Objectives: This is a foundational course on Data Modeling. The course aims to impart knowledge of the concepts related to database and operations on databases. It also gives the idea how database is managed in various environments with emphasis on security measures as implemented in database management systems.

Learning Outcomes: At the end of the course, student should be able to

- A) Understand the concepts of database and techniques for its management.
- B) Different Data Models at Conceptual and Logical level.
- C) Differentiate between the role of DBA and Data Architect
- D) Understanding Data Security standards and Methods

Pre-requisites: XII Standard Mathematics

Text Books:

Korth.(2006) Database Systems Concepts , Tata McGra-Hill, Fifth Edition

UNIT I: Introduction of Database Management System:

Difference between Data, Information, Data Processing & Data Management. File Oriented Approach, Database oriented approach to Data Management, Need for DBMS, Characteristic of Database, Database Architecture: Levels of Abstraction, Database schema and instances, 3 tier architecture of DBMS, Data Independence. Database users, Types of Database System. Database Languages, DBMS interfaces.

UNIT II: Data Modeling:

Data Models, Categories of Data Model, Logical Data Modeling: Hierarchical Data Model, Network Data Model, Relational Data Model, Advantages and Disadvantages of Logical Data Modeling. Conceptual Data Modeling: Entity Relationship Model, Entities, Attributes, Types of Attributes, Relationships, Relationship set, Degree of relationship Set, Mapping Cardinalities, Keys, ER Diagram Notations, Roles Participation: Total and Partial, Strong and Weak Entity Set.

UNIT III: Relational Algebra and Normalization:

Keys: Composite, Candidate, Primary, Secondary, Foreign, Relational Set Operations: Union, Intersect, Difference, Product, Select, Project, Divide, Assignment. Joins: Outer Joins, Inner Joins with example. Relational Algebra. CODD's Rules, Mapping conceptual model into Relational Model. Functional Dependencies, Decomposition, Lossy and Lossless Decomposition, Dependency Preserving Decomposition Advantages and Disadvantages of Normalization, Normal Forms(1NF, 2NF, 3NF, BCNF) Case Studies on Normalization.

UNIT IV: File Structures and Data Administration:

File Organization, Overview of Physical Storage Media, Magnetic Disk, RAID, Tertiary Storage, Storage Access, Data Dictionary Storage, Organization of File (Sequential, Clustering), Indexing and Hashing, Basic Concepts, indices, B+ Tree index file, B- tree index file, Static hashing, Dynamic Hashing, Data administration, Role and Responsibility of DBA, Creating/Deleting/Updating table space, Database Monitoring, User Management

UNIT V: Transaction and Concurrency Control

Single User and Multiuser systems, Multiprogramming and Multiprocessing, Basic Database access operations, Concept of transaction, transaction state, ACID properties, Schedules, Serializability of schedules., Concurrency Control, Need for Concurrency control, lock based protocols, timestamp based protocols, Multiple granularity, Multiple Version Techniques, Deadlock and its handling, Wait-Die and Wound-Wait, Deadlock prevention without using timestamps, Deadlock detection and time outs, Starvation

UNIT VI: Database Recovery and security Management:

Database Recovery, Types of Failures, Storage Structure: Volatile, Non Volatile and stable storage, Data access. Recovery and atomicity, Recovery Techniques Algorithms: Log Based Recovery, Check points, Shadow Paging, Recovery with concurrent transactions, Failure with loss of non-volatile storage, Basic data security principles, user privileges, data masking, encryption and decryption, Data security Implementation.