

UE18CS180: DATABASE MANAGEMENT SYSTEMS

Course Objectives:

The objective(s) of this course is to,

- Introduce fundamental concepts, terminology and application of databases.
- Teach design concepts and creation of relational databases.
- Teach basic and advanced SQL commands.
- Provide overview of database programming and procedural languages.
- Provide overview of transaction management, database recovery and security.

Course Outcomes:

At the end of the course, the student will be able to:

- Construct an Entity-Relationship (E-R) model from specifications and transform it to a relational model.
- Design databases and apply normalization constraints.
- Construct queries in SQL or Relational Algebra to perform CRUD (Create, Retrieve, Update and Delete) operations on database.
- Understand and apply the concepts of procedural languages.
- Apply the principles of database transaction management, database recovery and security.

Course Content:

1. **Introduction to Database and Conceptual Design using ERD:** Introduction to Databases, Conceptual Model, Conceptual Design using ERD, Entity, Weak Entity, Relationships, Attributes and Keys, Roles and Constraints, Relational Model, Constraints and Database Schemas, ER to Relational Mapping, Relational Algebra, Unary Operations - SELECT and PROJECT, Set Theory Operations, Binary Relational Operations - JOIN, DIVISION, Aggregate Functions and Grouping.
2. **SQL:** SQL Data Definition, Primary Data Types and Advanced Data Types like CLOB, BLOB, Specifying Constraints in SQL, Basic Retrieval Queries, Insert, Delete, Update and Schema Change Statements in SQL, Advanced SQL Queries, Specifying General Constraints as Assertions and Triggers, Views, Additional Features of SQL, Database Programming, PL/ SQL.
3. **Database Design:** Informal Design Guidelines for Schemas, Functional Dependencies, Inference Rules, Closure, Equivalence, Minimal Cover, Normal Forms Based on Primary Keys (1st, 2nd and 3rd NF), General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions, Overview of Higher Normal Forms.
4. **DBMS Architecture and Database Security:** Three-Schema Architecture, Data Abstraction and Data Independence, Database Languages and Interfaces, DBMS Modules, Database Security, Access Control.
5. **Transaction Management and Database Security:** ACID Properties, Transactions and Schedules, Serializability and Recoverability, Precedence Graphs, Concurrency, Lock-Based Protocols, 2PL, Strict 2PL Protocols, Timestamp-Based Protocols, Deadlocks - Detection and Prevention, Crash Recovery, Advanced Topics - NoSQL.

Pre-requisite Courses: None.

Reference Book(s):

1. "Fundamentals of Database Systems", Ramez Elamsri, Shamkant B Navathe, Pearson, 7th Edition, 2017.
2. "Database Management Systems", Johannes Gehrke, Raghu Ramakrishnan, McGraw-Hill, 3rd Edition, 2003.
3. "Database Systems: The Complete Book", Garcia-Molina, J D Ullman, Widom, 2nd Edition, Prentice-Hall, 2008.
4. "Database System Concepts", Silberschatz, H Korth, S Sudarshan, 6th Edition, McGraw-Hill, 2010.