SQL - Database Management

Course Overview

This course offers comprehensive training in SQL for database management, blending IT best practices with core computer science principles. Students will learn SQL syntax, engage in database design and normalization, and understand transaction management and security. The curriculum also explores emerging database technologies, preparing students for advanced database management tasks. Learners will design, implement, and manage databases, gaining practical skills essential for IT professionals.

Course Objectives

- Utilize SQL syntax for database creation, manipulation, and management.
- Apply principles of database design and normalization to ensure efficient data organization and integrity.
- Develop complex SQL queries, including JOINs, subqueries, and transactions, for advanced data manipulation and retrieval.
- Implement security measures including authentication, authorization, and encryption to protect database integrity and data privacy.
- Learn database administration techniques such as performance tuning, backup, and recovery to maintain and optimize database systems.
- Explore emerging database technologies, including NoSQL databases and cloud database services, to understand their applications and how they complement traditional SQL databases.

Unit 1: Introduction to Databases

Introduce relational database concepts and basic SQL commands.

- ☐ Overview of database systems
- ☐ Theoretical Models - Relational, CAP Theorem
- ☐ Database schema design
- ☐ Entity-Relationship (ER) modeling
- ☐ Basic SQL syntax: SELECT, INSERT, UPDATE, DELETE
- ☐ Data retrieval techniques and filtering data
- ☐ Hands-on Exercise: Setting up a database and executing basic SQL queries
- ☐ Introduction to normalization and denormalization
- ☐ Implementing constraints and indexes

- ☐ Hands-on Exercise: Design a normalized db schema using ER diagrams.
- ☐ **Unit 1 Test**

Unit 2: Advanced SQL

Master complex SQL queries and transactions.

- ☐ Complex queries (JOINs, subqueries, GROUP BY, HAVING)
- ☐ Views and stored procedures
- ☐ SQL Scripting and Automation
- ☐ Transaction management and concurrency control
- ☐ Performance tuning and query optimization
- ☐ Hands-on Exercise: Develop complex SQL queries and manage transactions
- ☐ **Unit 2 Test**

Unit 3: Database Security and Administration

Learn about securing databases and administrative tasks, and explore emerging database technologies and NoSQL databases.

- ☐ Authentication and authorization
- ☐ Data encryption and security best practices
- ☐ Backup and recovery techniques
- ☐ Database administration tasks (monitoring, tuning)
- ☐ Overview of NoSQL databases (Document, Key-Value, Graph, Column-Family)
- ☐ Use cases for NoSQL vs. SQL databases
- ☐ Introduction to data warehousing and big data technologies
- ☐ Overview of cloud database services (AWS RDS, Azure SQL Database, Google Cloud SQL)
- ☐ **Unit 3 Test**