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Course Code: INT104
Semester: IV

DATABASE MANAGEMENT SYSTEMS

Course Objectives:

This course will help the learner to infer the fundamentals of data models and to conceptualize and depict a database system using ER diagram. Construct tables and write effective queries to design and implement a database for real-world applications.

UNIT - I **11 Periods**

Introduction: Database-System Applications - Purpose of Database Systems **-** Data Abstraction - Data Independence - Database system architecture - Structure of Relational Databases - Database Schema – Keys - Schema Diagrams - Relational Query Languages - Relational Operations

Data models: The Entity-Relationship Model – Constraints - Removing Redundant Attributes in Entity Sets - Entity-Relationship Diagrams - Reduction to Relational Schemas - Entity-Relationship Design Issues. Hierarchical Model - Network Model.

Storage strategies: Dense and Sparse Indices - Multilevel Indices - Secondary Indices - Structure of a B+-Tree - Queries on B+-Trees**. Hashing:** Hash Functions - Handling of Bucket Overflows - Hash Indices.

UNIT - II **11 Periods**

Relational query languages: Overview of the SQL Query Language - SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations - Null Values - Aggregate Functions - Nested Subqueries - Modification of the Database - Join Expressions – Views - Integrity Constraints.

Relational database design: Features of Good Relational Designs - Atomic Domains and First Normal Form - Keys and Functional Dependencies - Boyce–Codd Normal Form - BCNF and Dependency Preservation - Third Normal Form - Functional-Dependency Theory - Multivalued Dependencies - Fourth Normal Form - More Normal Forms.

UNIT - III **12 Periods**

Query processing and optimization: Overview - Measures of Query Cost - Selections Using File Scans and Indices - Nested-Loop Join. **Query optimization:** Overview – Transformation of Relational Expressions.

Transaction processing: Transaction Concept - A Simple Transaction Model - Transaction Atomicity and Durability - Transaction Isolation – Serializability. **Concurrency Control:** Lock-Based Protocols - Implementation of Locking – **Deadlock:** Deadlock Prevention - Deadlock Detection - Recovery from Deadlock **-** Timestamps - The Timestamp-Ordering Protocol - Validation-Based Protocols - Multiversion Timestamp Ordering - Multiversion Two-Phase Locking - Failure Classification - Recovery Algorithm.

UNIT - IV **11 Periods**

Database Security: Introduction to Database Security Issues, DAC, MAC and RBAC models, SQL injection.

Advanced topics: **Object oriented and object relational databases**: Complex Data Types - Structured Types and Inheritance in SQL - Type Inheritance. **Web databases**: Ranking Using TF-IDF - Similarity-Based Retrieval. **Distributed databases**: Homogeneous and Heterogeneous Databases **-** Data Replication - Data Fragmentation **Data warehousing and data mining**: Components of a Data Warehouse - Warehouse Schemas – Data Mining – classification - clustering

Case Study*: MYSQL, DB2, SQL server.

***Case studies are meant for comparison study only and not for end-semester examinations**

TEXT BOOKS

1. Henry F.Korth, Abraham Silberschatz, Sudarshan. *Database System Concepts*, McGraw Hill, 6th Edition, 2010.
2. R.Elmasri, S.B.Navathe. *Fundamentals of Database Systems*, Addison Wesley, 7th Edition, 2016.

REFERENCES

1. J. D. Ullman. *Principles of Database and Knowledge Base Systems*, Vol 1, Computer Science Press, 1988.
2. Serge Abiteboul, Richard Hull and Victor Vianu. *Foundations of Databases*. Addison Wesley, 1995

ONLINE MATERIALS

1. https://nptel.ac.in/courses/106105175/1
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/

COURSE LEARNING OUTCOMES

- Upon successful completion of this course, the learner will be able to
- Compare and contrast database systems from file systems and describe the fundamental elements of relational database management systems
- Construct ER models to represent simple database application scenarios and employ appropriate Storage Strategies.
- Build SQL queries for the given scenario
- Examine the normalization concepts to refine the database design
- Apply various concurrency control techniques in transaction processing system
- Outline the basic constructs in Advanced databases