Annexure – III

Advanced Database Management Systems

Course Code: MCST1C013T
Course Title: Advanced Database Management Systems
Semester: II
Credits: 03+02

Rationale

The study of DBMS is essential for acquiring the skills needed to manage data effectively, support organizational processes, and contribute to informed decision-making in the digital age. The role of DBMS is also seen in supporting and streamlining various business processes by providing a centralized and structured data repository. By including topics like SQL, normalization, transaction management, and emerging database technologies, the course prepares students to address real-world challenges in data management and equips them with the skills required in today's data-driven environment.

Course Outline

Contents	No. of Lectures
Unit-I **Introduction to Database:** Objectives , Data and Information, Need for Databases, Traditional File Based Approach Vs Database, Building Blocks, Characteristics, Components of Database System Environment, Instances, schemas and subschema. **DBMS Architecture:** Three level Architecture, Data Independence, Database languages, Data Models- Object Based Data Models, Physical Data Models, Record Based Logical Models Network model, Hierarchical model, Relational model and Data dictionary.	10
Unit-II **Entity Relationship Model:** E-R Diagrams, Constraints Entity Types, Entity Sets, Generalization, Specialization. And Aggregation, Coversion of ER Diagrams into tables. **Relational Database Model:** Relation Data Structure- relation, entities, attributes, Domain, Relational Keys-Types of keys, relationships, Relational Integrity Rules-Entity Integrity rules, Referential Integrity,Codd's rules.	10
Unit-III **Relational Algebra and Calculus:** Types of Relational Operators, Traditional set operators, Special Relational operators.Tuple Oriented Relational Calculus, Domain Oriented Relational Calculus, Relational Algebra Vs Relational Calculus. . **Structured query languages**, Fundamentals, DDL, DML,and DCL,views, Queries in SQL, Specifying Constraints in SQL.	10

Normalization For Refinement of Data-Introduction, Functional Dependency,Fully Functional Dependency,1NF,2NF,3NF,Boyce-Codd Normal Form (BCNF),4NFand 5NF.	
Unit-IV **Transaction Management and Concurrency control:** Concept of Transaction, States of Transaction and its properties, Problem of Concurrency control, Solution of Inconsistency Problem, Concurrent Control Algorithms: Two phase locking protocol. **Security and Integrity of Data:** Security levels, Data security requirements, View **Recovery Management:**Causes of failure, Recovery and atomicity of a transaction, Log based recovery, Checkpoints and Shadow paging.	10
Unit-V **Advanced Topics:** Query Optimization and Processing, temporal Databases, Embedded SQL,Introduction to Big Data and Hadoop Ecosystem, NoSQL Databases. Case Studies: MongoDB, Cassandra.	10

COURSE OUTCOMES

Upon successful completion of the course the student will be able to:

1. Understand the objectives, components, and advantages of database systems compared to traditional file-based approaches.
2. Apply and analyze various data models for designing and implementing efficient databases.
3. Design E-R diagrams, ensure data integrity using relational keys and rules, and execute SQL queries for defining, manipulating, and controlling data while optimizing database structures through normalization.
4. Address transaction management, concurrency control, data security, and recovery mechanisms to ensure reliable and secure database systems
5. Demonstrate an understanding of advanced database topics, including query optimization, NoSQL databases, and Big Data technologies,

Textbooks

1. Silberschatz, A., Korth, F. H., and Sudarshan, S., *Database System Concepts*, Tata McGraw Hill (2019), 7th Edition.
2. Elmasri, R., and Navathe, B. S., *Fundamentals of Database Systems*, Pearson (2016), 7th Edition.

Reference Books

1. C. J. Date, *An Introduction to Database Systems*, Addison-Wesley (2018), 8th Edition.
2. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, *Database Systems: The Complete Book*, Pearson Prentice Hall (2008), 2nd Edition.
3. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw-Hill Education (2002), 3rd Edition.