FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Engineering (Information Technology)**

Semester: **III**

Course Code: **102040302**

Course Title: **Database Management System**

Course Group: **Professional Core Course**

Course Objectives: The main objective of this course is to understand the basic database concepts, apply ER and Relational data model in database design, apply the concept of transaction management, concurrency control, security, and recovery on database. Moreover, this subject will help in identifying the purpose of query processing and query optimization. Further, it will help in recognizing the storage and structure of files. Also, it will facilitate in design SQL and relational algebra queries and database system.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
4	0	2	5	40 / 14	60 / 21	20/7	30/10	150 / 52

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction:** Database system applications, Purpose of Database Systems, Database System Concepts (Data Models, Schema, instances, views), Approaches to building a database system, Database System architecture and its components, data independence, classification of DBMS, Challenges in building a DBMS, role of DBA	04

2	**Database Models:** Entity Relationship Model (ER Model): Basic concepts, Entities (Entity types, Entity sets, attributes, keys), Relations (Relationship types, relationship set, roles, structural constraints), Design process, ER diagrams, Design issues, weak entity sets, extended ER features –generalization, specialization, inheritance, aggregation, design of ER Database schema, reduction of ER database schema to tables, Object oriented data models. Relational Data Model: Concept of relations, Schema-instance distinction, Structure of relational databases, Domains, Relational algebra operators (Unary and Binary) and queries, relational algebra operators from set theory, ER to Relational mapping.	**08**
3	**Relational Database Design:** Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory -functional dependencies, Armstrong's axioms for FDs, Closure of a FD set and attribute set, irreducible set of FD, Minimal covers, Normalization - 1NF, 2NF, 3NF and BCNF, Properties of Relational decompositions, Multi-valued dependencies and 4NF, Join dependencies and 5NF.	**09**
4	**SQL query:** Basics of SQL, DDL, DML, DCL, structure creation, alteration, defining constraints, Primary key, foreign key, unique, not null, check, IN operator, Functions -aggregate functions, Built-in functions numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. Transaction control commands, Commit, Rollback, Save point. Embedded SQL, PL SQL Concepts, Cursors, Stored Procedures, Stored Function, Database Triggers.	**05**
5	**Transaction Management:** Transaction: Transaction processing concepts, schedule, properties of transactions, serializability, characterizing schedules based on recoverability and serializability, Concurrency control: Problems of Concurrent transactions execution and need of concurrency control, Lock based protocols, deadlock handling (deadlock prevention, detection and recovery), Multiple granularity, Timestamp protocol, isolation, intent locking Error recovery: Recovery concepts, Transaction recovery, System recovery, media recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, recovery techniques and algorithms	**10**
6	**Query Processing and Optimization:** Query parsing and translation, measures of query cost, relational algebra operation evaluation, relational algebra expression evaluation (materialization and pipelining), expression evaluation plans, transformation of relational expressions, cost-based query optimization.	**08**
7	**Security:** Authentication, authorization, and Access Control (DAC, MAC and RBAC model), intrusion detection, Multi-Level Security, Statistical Databases security, Data Encryption.	**06**

8	**Storage and Structure:** Storage media, RAID, File structure, Indexing and Hashing	**06**
	Total	**56**

List of Practicals / Tutorials:

1	Creating and Manipulating Database objects and Applying Constraints (DDL)
2	Manipulating Data with Database Objects (DML)
3	Retrieving, Restricting and Sorting Data (DRL)
4	SQL Single Row Functions
5	SQL Multiple Row Functions (Aggregate Function)
6	Displaying Data from Multiple Tables (Join)
7	Using Commit and Rollback show Transaction ACID Property.
8	Securing data using Views and Controlling User Access (DCL)
9	PL/SQL Block Syntax and DML Operation through PL/SQL Block
10	Control Structures in PL/SQL
11	Working with Cursor
12	Creating Procedures and Functions in PL/SQL
13	Creating Database Triggers
14	Design Database Management System with all the required documentation and specification.

Reference Books:

1	A Silberschatz, H F Korth and S Sudarshan, "Database System Concepts", McGRAW Hill.
2	C. J. Date, A. Kennan, and S. Swamynathan, "An Introduction to Database Systems", Person Education
3	Ramez Elmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Pearson Education
4	Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publication.

Supplementary learning Material:	
1	NPTEL course / tutorials
2	Vlabs.iitb.ac.in
3	Open online courses from www.coursera.org, www.udacity.com, Swayam etc.

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20%	20%	20%	15%	15%	10%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand database management systems and query languages.	**15**
CO-2	Construct an Entity-Relationship (E-R) model from specifications and transform it into relational data model.	**15**
CO-3	Design normalized database.	**20**
CO-4	Understand principles of database transaction management, database recovery, and security.	**20**
CO-5	Manage the processing of queries and its optimization.	**10**
CO-6	Analyze the concepts of file structure and its storage.	**10**
CO-7	Develop, install and configure a database management system for business application and formulate queries to access the database	**10**

Curriculum Revision:	
Version:	1.0
Drafted on (Month-Year):	June-2020
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025