25CAMJ205: Database Management Systems

w. e. f. Academic Year:	**2026-27**
Semester:	**B.E. 3rd (Computer Engineering/ Computer Science and Engineering/ Information Technology)**
Category of the Course:	**PCC**
Prerequisite:	Basic mathematics and logic (sets, relations, functions)
Rationale:	Database Management System (DBMS) is a fundamental pillar of Computer Engineering and Information Technology. This course equips students with the essential concepts and practical skills required to organize, store, retrieve, and manage data efficiently in modern software applications. By mastering data models, normalization, SQL/PL-SQL, and transaction management, students develop the ability to build robust, scalable, and secure data-driven systems.

Course Outcomes:

After Completion of the Course, Student will able to:

CO No.	Course Outcome (CO)	RBT Level (Cognitive Domain)
CO1	Explain DBMS architecture, data models, and the advantages of database systems over traditional file systems.	Understand
CO2	Design ER models and apply normalization rules (1NF to BCNF) to create optimized relational database schemas.	Apply/Create
CO3	Construct complex SQL queries and PL/SQL programs (procedures, functions, triggers) for data management.	Apply/Analyze
CO4	Apply transaction management principles and ACID properties to ensure database consistency.	Apply
CO5	Evaluate concurrency control protocols and recovery techniques in multi-user database environments.	Evaluate

Teaching and Evaluation Scheme:

Teaching Scheme					Examination Scheme				
L	**T**	**P**	**C**	**Hrs/Week**	**IE**	**EE**	**CIA**	**Practical**	**Total Marks**
3	0	2	4	5	40	60	30	20	150

IE: Internal Evaluation EE: External Exam (End Semester)

CIA: Continuous Internal Assessment Practical: Practical Exam (End Semester)

Detailed Syllabus:

Unit No.	Topic	Hrs.	Marks % Weightage (Approx.)
UNIT: 1	**Basic Concepts and Architecture of Database** Database Systems versus File Systems, Data Abstraction, Data Independence, Applications of Database Systems, Database Users. Understand and explain database fundamentals supporting Quality Education and Industry, Innovation and Infrastructure.	10	15
UNIT: 2	**Data Models and ER Design** Entity-Relationship (ER) Model: Entities, Attributes, Relationships. Relational Model basics and Integrity Constraints. Design and develop data models for industry and innovation.	5	15
UNIT: 3	**Relational Database Design and Normalization** Basic System Development Life Cycle, Functional dependencies, Normalization, Normal forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF), Loss less joins and dependency preserving decomposition. Apply and implement efficient queries for sustainable data usage	10	20
UNIT: 4	**Relational Query Languages and SQL** DDL (Data Definition Language), Data Dictionary, DML (Data Manipulation Language), DRL (Data Retrieval Language), DCL (Data Control Language), TCL (Transaction Control Language), SQL Functions and Aggregate Functions, Join Operations, Views. Authentication, Authorization. Set Operations. Analyze and evaluate system reliability in real-world applications	5	25
UNIT: 5	**Transaction Management and Concurrency** Introduction and Properties of Transaction- ACID property, Concurrent execution of transactions. Serializability of scheduling – Conflict and View Concurrency Control-Lock – Based Protocols, Timestamp-based Protocols Database Recovery – Failure classifications, Log Based Recovery, Checkpoints. Evaluate and assess secure and sustainable database technologies	15	25

List of Tutorial and /or Practical:

Sr No	Topic	Hrs
1	Creating and Manipulating Database Objects (Table). – DDL	02
2	Including and Enforcing Constraints on the table. – DDL	02
3	Manipulating Data with Database Objects. – DML	02
4	Retrieving, Restricting and Sorting Data. – DRL	02

5	SQL Single Row Functions.	02
6	SQL Multiple Row Functions (Aggregate Function).	02
7	Displaying Data from Multiple Tables (Join).	02
8	Using Commit and Rollback show Transaction ACID Property.	02
9	Securing data using Views and Controlling User Access (DCL).	02
10	Database SET Operations.	02
11	PL/SQL Block Syntax and DML Operation through PL/SQL Block.	02
12	Control Structures in PL/SQL.	02
13	Working with Cursor.	02
14	Creating Procedures and Functions in PL/SQL.	02
15	Creating Database Triggers.	02

Learning Resources:

1 Text Books

- Database System Concepts, Silberschatz, Korth, Sudarshan, McGraw Hill.
- Fundamentals of Database Systems, Elmasri & Navathe, Pearson.

2 Reference Books

- Principles of Database and Knowledge-Base Systems, J.D. Ullman.
- Foundations of Databases, Abiteboul, Hull, Vianu.
- Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill.

3 Online References

- NPTEL: Database Management Systems by Prof. Partha Pratim Das (IIT Kharagpur).
- Coursera: Database Management Systems Specialization (University of Colorado).
- Oracle Academy: SQL and PL/SQL Fundamentals.
- W3Schools: SQL Tutorial for interactive learning.

Teaching Learning Method

- Lecture-based teaching-learning
- Group-teaching and learning
- Individual learning/self-study
- Inquiry-based learning
- Kinesthetic learning / Practicals
- Game-based learning
- Expeditionary learning (Real-world problems)
- Technology-based Learning
- Peer Teaching
- Learning through problem-solving

Course Outcomes Mapping:

CO No.	Course Outcome (CO)	POs/ PSOs Mapped	Cognitive Level (RBT)	Knowledge Category	Class Sessions (Lecture)
CO1	Explain DBMS architecture, data models, and the advantages of database systems over traditional file systems.	PO1, PO2, PO11, PSO1, PSO2	Understand	Conceptual (K2)	10
CO2	Design ER models and apply normalization rules (1NF to BCNF) to create optimized relational database schemas.	PO1, PO2, PO3, PO4, PO11, PSO1, PSO2	Apply/Create	Procedural (K3)	5
CO3	Construct complex SQL queries and PL/SQL programs (procedures, functions, triggers) for data management.	PO1, PO2, PO3, PO5, PO11, PSO1, PSO2	Apply/Analyze	Procedural (K3)	10
CO4	Apply transaction management principles and ACID properties to ensure database consistency.	PO1, PO2, PO3, PO11, PSO1, PSO2	Apply	Procedural (K3)	5
CO5	Evaluate concurrency control protocols and recovery techniques in multi-user database environments.	PO1, PO2, PO3, PO4, PO11, PSO1, PSO2	Evaluate	Conceptual (K2)	15

Mapping of COs with POs & PSOs:

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1
CO2	3	3	3	2	-	-	-	-	-	-	1	3	2
CO3	2	2	3	-	3	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	1	3	1
CO5	2	3	2	2	-	-	-	-	-	-	1	3	1

3: High, 2: Medium, 1: Low

Sustainable Development Goals (SDG) Integration

This course integrates principles of sustainable engineering by Promoting Quality Education **(SDG 4)**, Decent Work and Economic Growth **(SDG 8)**, Industry, Innovation and Infrastructure **(SDG 9)**, Responsible Consumption and Production **(SDG 12)**, and Climate Action **(SDG 13)** by fostering knowledge, innovation, sustainable practices, and responsible growth.

SDG Mapping with Course Outcomes

CO	Course Outcome	Relevant SDGs	Justification
CO1	Describe DBMS architecture, data models, and key database concepts.	SDG 4, SDG 9	Promotes quality education and supports digital infrastructure development
CO2	Design ER models and apply normalization to develop relational databases.	SDG 8, SDG 9	Enables industry-relevant skills and supports innovation in system design
CO3	Write SQL and PL/SQL programs for data management and control	SDG 12, SDG 13	Encourages efficient data handling, reducing redundancy and energy consumption
CO4	Learn the transaction concepts and its properties.	SDG 4, SDG 8, SDG 9	Enhances problem-solving skills and ensures reliable systems in industries
CO5	Evaluate database security and emerging technologies with a focus on sustainable and energy-efficient data management.	SDG 9, SDG 12, SDG 13	Supports sustainable and secure data systems while promoting resource-efficient technologies