Course Code:CS7044

Course Title: Relational Database Management Systems

Course Credits: [Lecture: 03, Tutorial: 00, Practical: 01]

Prerequisites:Basic concepts of DBMS and data retrieval from structured data store.

Objectives:To introduce the fundamentals of relational database design, transaction processing, concurrency control and enhance the skills for designing procedural SQL for effective database applications development.

Course Outcomes: Upon completion of the course, students shall be able to

CO1: Design good relational database design

CO2: Design user defined cursor, functions and stored procedures using procedural SQL

CO3: Demonstrate creating and firing of triggers.

CO4: Understand the concept of Transaction processing

CO5: Determine the conflict Serializability of a schedule.

CO6: Demonstrate creating and dropping of index.

Course Objective and Course Outcomes Mapping:

- To introduce the fundamentals of relational database design: CO1
- Transaction processing, concurrency control: CO4, CO5
- Enhance the skills for designing procedural SQL for effective database applications development.: CO2, CO3, CO6

Programme Outcomes:The student will have

PO1-Computational Knowledge: Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.

PO2-Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3-Design /Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4-Conduct Investigations of Complex Computing Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of t h e information to provide valid conclusions.

PO5-Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6-Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PO7-Life-long Learning: Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8-Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9-Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10-Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

PO11-Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12-Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Programme Outcomes and Course Outcomes mapping:

Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	0	0	0	0	0	0	0	0	0	3	0
CO2	2	3	2	0	0	0	0	3	0	0	0	0
CO3	0	1	3	0	0	0	0	3	0	0	0	0
CO4	0	0	0	2	3	0	0	3	0	0	0	0
CO5	0	0	0	3	3	3	2	0	3	3	0	0
CO6	0	0	0	0	3	0	0	3	0	0	0	0

Curriculum Unit Titles

Units   Unit Description   Weightage

1   Relational Database Design   [20%]

    1.1.   E.F. Codd's Rule

    1.2.   Functional dependency

    1.3.   Anomalies in database design: Redundancy, Insertion, Updation and Deletion anomalies

    1.4.   Decomposition of Relations, and Lossy and Lossless Join

    1.5.   Normalization: First Normal Form, Second Normal Form, Third Normal Form

2   Procedural SQL   [15%]

    2.1.   Compound statements and labels

    2.2.   Overview of Control and Iterative statements: IF, CASE, LEAVE, WHILE, LOOP

    2.3.   Cursors: OPEN, CLOSE and FETCH

    2.4.   User Defined Function: Need, RETURN statement

    2.5.   Stored Procedure: Need and usage

3   Triggers   [15%]

    3.1.   Triggers and their usage

    3.2.   Trigger Activation

    3.3.   BEFORE and AFTER trigger

    3.4.   COMMIT, ROLLBACK, SAVEPOINT

4   Transaction processing   [15%]

    4.1.   Concepts in Transaction Processing

4.2.	Desirable Properties of Transactions
4.3.	Serial, Non-Serial Schedules
4.4.	Conflict Serializability

5 Concurrency Control   [20%]

5.1.	Concurrent Transactions: Purpose
5.2.	Concurrency Control Protocol: Two Phase Locking(2PL) Protocol
5.3.	Deadlock and Starvation
5.4.	Deadlock Detection and Resolution: Wait-for graph

6 SQL Indexes   [15%]

6.1.	Overview, Advantages and Disadvantages of Indexing
6.2.	Creating Indexes: Simple, Composite, Unique
6.3.	Multiple Indexes
6.4.	Dropping Indexes

Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Relational Database Design	✓					
2	Procedural SQL		✓	✓			
3	Triggers		✓	✓			
4	Transaction Processing				✓		
5	Concurrency Control					✓	
6	SQL Indexes		✓				✓

Computing Environment:

A student must have the following computing environment in the laboratory and/or on his/her laptop.

- MySQL 8.0 or above
- PostgreSQL 9.5 or above
- Both the DBMS must be used to demonstrate the topics of unit 2, 3 and 6.

Text Books

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education.
2. Ivan Bayross, MySQL 5 for Professionals, SPD.

References:

1. Korth, Database System Concepts, Tata McGraw Hills.
2. MySQL Reference Manual - https://dev.mysql.com/doc/refman/8.0/en/
3. Singh, Database Systems: Concepts, Design and Applications, Pearson Education.
4. https://www.postgresql.org/docs/9.5/static/index.html