24UAMPC205	Database Management System	L/T/P
		3/0/2
Nature of Course	Theory and Practical	
Prerequisites		

Course Objectives:	
1.	To Understand the basic concepts and the applications of database systems
2.	To Master the basics of SQL and construct queries using SQL
3.	To understand the relational database design principles
4.	To become familiar with the basic issues of transaction processing and concurrency control
5.	Perform file operations, use regular expressions, handle exceptions, and interact with databases.

Course Outcomes: Upon completion of the course, students shall have the ability to		
CO1	**Demonstrate** the basic elements of a relational database management system	[U]
CO2	**Apply** control flow Ability to identify the data models for relevant problems and create functions to solve problems (Applying).	[U]
CO3	Ability to **Design** entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data	[AP]
CO4	**Apply** normalization for the development of application software's·	[A]
CO5	**Analyze and Optimize** the cost of relational database queries using various techniques	[A]

CO-PO Mapping

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	POS3
CO1	3	3	1	1	2	-	-	-	-	1	1	2	3	1	2
CO2	3	3	2	2	3	-	-	-	1	2	2	2	2	3	1
CO3	3	3	3	2	3	-	-	-	1	2	2	2	2	3	1
CO4	3	3	2	3	3	1	-	3	1	1	2	2	3	2	3
CO5	3	2	3	2	3	-	-	-	1	2	3	2	3	3	2

Teaching -Learning & Assessment Scheme

Learning Scheme			Credits	Assessment Scheme			Summative Assessment	Total
				Formative Assessment			End Semester Exam	
L	T	P		CIA-I	CIA-II	Model PR Exam		
3	0	2	4	25	25	20	60 Scaled Down 30	100

CIA Conduction (for TH + PR)

CIA	Proposed Conduction Method / Activities
CIA 1	**CIA -1 Paper (25 Marks)**
CIA 2	**CIA -2 Paper (25 Marks)**
Model PR	**Assignments (5 each for 10 marks then scaled down to 20)**

Course Contents

UNIT I	Introduction to Database Management System	9hrs

Basic concepts, Advantages of DBMS over file processing systems, Data abstraction, Database languages, Data models, Data independence, Components of a DBMS, Overall structure of DBMS, Multi-user DBMS architecture, System catalogs, Data Modeling: Basic concepts, Entity, attributes, relationships, constraints, keys.

ER and EER diagrams: Components of ER model, Conventions, Converting ER diagrams into tables Relational Model: Basic concepts, Attributes and Domains, Codd's rules.

Case Study: MySQL Database (Study the Xampp Server and create a small database for student information).

UNIT II	Introduction to SQL PL/SQL	9hrs

Introduction to SQL: Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls.

SQL DML Queries: SELECT query and clauses, Set operations, Tuple Variables, Set comparison, Ordering of Tuples , Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update, Delete Queries, Stored Procedure, Triggers, Programmatic **SQL** : Embedded SQL, Dynamic SQL, ODBC

Case Study: Design the student or employee database management system.

UNIT III	Database Design & Query Processing	9hrs

Relational Databases Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependencies. The process of Normalization: 1NF, 2NF, 3NF, BCNF. Introduction to **Query Processing:** Overview, Measures of Query cost, Selection and Join operations, Evaluation of Expressions

Introduction to Query optimization: Estimation, Transformation of Relational Expression

Case Study: An e-commerce platform experiences rapid growth and needs to optimize its database structure. They apply normalization techniques up to Boyce-Codd normal form to eliminate redundancy and ensure data integrity. This improves query performance and simplifies maintenance of their customer and product databases.

UNIT IV	Transaction & Concurrency Control	9hrs

Transaction Management: Basic concept of a Transaction, Properties of Transactions, Database Architecture, Concept of Schedule, Serial Schedule.

Serializability: Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules.

Concurrency Control: Need Locking methods Dead locks, Time stamping Methods. Optimistic Techniques, Multi-version Concurrency Control.

Different crash recovery methods: Shadow-Paging, Log-based Recovery: Deferred and Immediate, Check Points

Case Study: A banking institution handles millions of transactions daily and requires robust transaction management. They implement concurrency control mechanisms such as timestamp-based protocols and lock-based protocols to ensure transaction isolation and atomicity. Advanced recovery systems like log based recovery protect against system failures and ensure data consistency.

UNIT V	Advanced Databases	9hrs

Database Architectures: Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design.

Emerging Database Technologies: Introduction, No SQL Databases-Internet Databases, Cloud databases, Mobile Databases, SQLite database, XML databases.

Case Study: A logistics company tracks shipments and manages inventory across multiple warehouses. They optimize their database queries using techniques such as index selection, query rewriting, and cost estimation. This ensures efficient retrieval of shipment status, inventory levels, and delivery schedules, supporting their logistics operations effectively.

	Total Contact Hours:	45hrs

Laboratory Component:	
S.No.	**List of Experiments**
1.	Install and set up MySQL. Create a database and a table to store employee details. Perform basic operations like INSERT, UPDATE, and DELETE using SELECT queries.
2.	Design an ER diagram for a Roadway Travel Management System with entities like Customer, Travel Route, and Booking. Create tables and perform operations such as bookings and route assignments.
3.	Create a table with columns for EmployeeID, Name, Salary, JoiningDate, and ActiveStatus using different data types. Insert sample data and perform queries to manipulate and retrieve data.
4.	Create a table to store employee information with constraints like Primary Key, Foreign Key, and Unique. Insert valid and invalid data to test the constraints.
5.	Create a table for Customer details with various integrity constraints like NOT NULL, CHECK, and DEFAULT. Insert valid and invalid data to test these constraints and ensure data integrity.
6.	Use DDL commands to create tables and DML commands to insert, update, and delete data. Write SELECT queries to retrieve and verify data changes.
7.	Normalize an unnormalized schema for storing customer orders into 1NF, 2NF, 3NF, and BCNF. Apply key constraints like Primary Key and Foreign Key.
8.	Create a Sales table and use aggregate functions like COUNT, SUM, AVG, MIN, and MAX to summarize sales data and calculate statistics.
9.	Write a PL/SQL block to calculate the grade of minimum 10 students.
10.	Design and implement any 5-query using MongoDB.
Text Book:	
1.	Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan
2.	Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke
3.	Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe
4.	Principles of Database Systems by Jeffrey D. Ullman
Reference Book:	
1.	Database Design for Mere Mortals by Michael J. Hernandez
2.	SQL in 10 Minutes, Sams Teach Yourself by Ben Forta
3.	Introduction to Database Systems by C.J. Date
4.	Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
Web References:	
1.	https://www.w3schools.com/sql/
2.	https://www.tutorialspoint.com/dbms/index.htm
3.	https://www.geeksforgeeks.org/dbms/
4.	https://sqlzoo.net/
Online Resources:	
1.	Coursera - Database Management Essentials by the University of Colorado https://www.coursera.org/learn/database-management
2.	Data Base Management System https://onlinecourses.nptel.ac.in/noc22_cs91/preview
3.	Official Python Documentation: https://www.python.org/
4.	MIT OpenCourseWare - Introduction to Computer Science and Programming in Python: https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/