Code: BCS403 **Course: Database Management System**
Credits: 4 **L:T:P - 3:0:2**
SEE: 100 Marks **CIE: 100 Marks**
SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	1. Understand the fundamental concepts of databases, including database languages, architectures, and conceptual data modeling using entities and relationships. 2. Gain proficiency in relational database management systems, including the relational model, relational algebra, normalization, SQL, and transaction processing.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe fundamental concepts of database management systems, including architecture, languages, and functionalities.	Understand
CO2	Design and implement database schemas using entities, relationships, and normalization techniques.	Apply
CO3	Demonstrate proficiency in SQL for data manipulation, retrieval, and management tasks.	Apply
CO4	Analyze and compare concurrency control mechanisms in relational databases and NoSQL databases, understanding their respective advantages and limitations.	Analyze

Mapping with POs and PSOs:

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

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction to Databases				
1.1	**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.	2	-	0
1.2	**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence. Database languages, and interfaces, The Database System environment.	3	-	0
1.3	**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams, Specialization and Generalization	3	-	1
Module – 2: Relational Databases				
2.1	**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas,Update operations, transactions, and dealing with constraint violations.	3	-	0
2.2	**Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate,grouping, etc.) Examples of Queries in relational algebra.	3	-	0
2.3	**Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relationalmapping	2	-	0
Module – 3: Normalization and SQL				

3.1	**Normalization:** Database Design Theory – Introduction to Normalization using Functional and MultivaluedDependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms basedon Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency andFourth Normal Form, Join Dependencies and Fifth Normal Form.	5	-	1
3.2	**SQL:** SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL,retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	3	-	2
	Module – 4: SQL and Transactions			
4.1	**SQL:** Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions andaction triggers, Views in SQL.	3	-	2
4.2	**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirableproperties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules basedon Serializability, Transaction support in SQL.	5	-	1
	Module – 5: Concurrency control and NoSQL Databases			
5.1	**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrencycontrol based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrencycontrol techniques, Granularity of Data items and Multiple Granularity Locking.	4	-	1
5.2	**NoSQL Databases and Big Data Storage Systems:** Introduction to NOSQL Systems, The CAP Theorem,Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or WideColumn NOSQL Systems.	4	-	2
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**10**

PRACTICAL COMPONENT

Sl. No.	Experiments	COs
1.	Create a table called Employee & execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert any three records in the employee table containing attributes. EMPNO, ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback.Check the result. 3. Add primary key constraint and not null constraint to the employee table. 4. Insert NULL values to the employee table and verify the result.	CO3
2.	Create a table called Employee that contains attributes EMPNO,ENAME,JOB, MGR,SAL and execute the following. 1. Add a column commission with domain to the Employee table. 2. Insert any five records into the table. 3. Update the column details of job. 4. Rename the column of Employ table using alter command. 5. Delete the employee whose EMPNO is 105.	CO3
3.	Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby. Employee(E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employee table. 3. Find the Maximum age from the employee table. 4. Find the Minimum age from the employee table. 5. Find salaries of employees in Ascending Order. 6. Find grouped salaries of employees.	CO3

4.	Create a row level trigger for the customers table that would fire for INSERT or UPDATE orDELETE operations performed on the CUSTOMERS table. This trigger will display thesalary difference between the old & new Salary. CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)	CO4
5.	Create cursor for Employee table and extract the values from the table. Declare the variables,Open the cursor, and extract the values from the cursor. Close the cursor. Employee(E_id, E_name, Age, Salary)	CO4
6.	Install an Open-Source NoSQL Data base MongoDB & perform basic CRUD(Create, Read,Update & Delete) operations. Execute MongoDB basic Queries using CRUD operations.	CO5
7.	Project-based Experiment: The project should use all the database concepts covered in theory and laboratory sessions. Students can integrate other relevant concepts/technologies as required.	CO1, CO2, CO3, CO4.

Textbook:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.

Reference Book:

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.

Online Resources:

1. MIT OpenCourseWareCourse Link: https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/
2. IIT Kharagpur Course Link: https://cse.iitkgp.ac.in/~pabitra/course/dbms/dbms_new.html
3. NPTEL Course Link: https://onlinecourses.nptel.ac.in/noc22_cs91/preview

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