PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				**23BCMAL232**			
Title of the Course				**Database Management Systems**			
Offered to: (Programme/s)				**B. C. A HONS**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**Major Theory**			**Course Relates to:**	**Global / National / Regional / Local**		
Year of Revision:				**Percentage:**			
Type of the Course:				Skill Development / Employability			
Crosscutting Issues of the Course :							
Pre-requisites, if any				Basic Computer and Programming Knowledge			

Course Description:

This course provides a comprehensive introduction to the principles and practices of database management systems. Students will start with fundamental concepts, including database users, characteristics, and advantages of the DBMS approach. They will learn about data models, schemas, and database architectures. As they progress, students will explore data modeling using the ER model, the relational data model, and SQL for database operations. Advanced topics include normalization, relational database design, transaction processing, and concurrency control techniques. By the end of this course, students will have a solid understanding of designing, managing, and optimizing databases efficiently.

Course Aims and Objectives:

S. NO	COURSE OBJECTIVES
1	Introduce students to the fundamental concepts of DATABASE.
2	Explain the architecture and components of database systems, including data models, schemas, instances, and the three-schema architecture
3	Solve real-world database design problems by applying normalization techniques and understanding functional dependencies to ensure data integrity and efficiency
4	Demonstrate the process of data modeling using the Entity-Relationship (ER) model and relational model, emphasizing the importance of attributes, keys, and constraints.
5	Familiarize students with SQL and PL/SQL including schema definition, constraints, queries, and views, to proficiently interact with and manipulate relational databases.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Understand fundamental database concepts and architecture and data models	K2	**1,2**	**1**
CO2	Normalize schemas to ensure data integrity and reduce redundancy	**K3**	**1,2**	**1**
CO3	Demonstrate proficiency in using SQL for defining and manipulating database structures	**K4**	**1,2**	**1**
CO4	Develop the ability to perform data retrieval using joins, subqueries and nested subqueries	**K3**	**1,2**	**1**
CO5	Gain proficiency in developing PL/SQL programs and handling exceptions.	**K4**	**1,2**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	**3**	**2**						**2**	
CO2	**2**	**3**						**2**	
CO3	**2**	**3**						**3**	
CO4	**3**	**3**						**2**	
CO5	**3**	**3**						**3**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1 : Overview of Database Systems (12Hrs)

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications.

Data Models: Introduction; types of data models, Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Description:

A database system is a system for managing data that allows users to store, modify, and extract information from a database. It provides a systematic and organized way of managing data.

Learning Outcome:

- Understand the fundamental concepts and purpose of database systems.
- Develop the ability to differentiate between databases and traditional file systems.
- Appreciate the role of databases in modern applications and enterprises.

- **Exercises:**

  Databases and Database Users

- Explain with an example how a database differs from traditional file processing systems.
- Discuss the advantages of using a DBMS approach over traditional file processing systems.
- Outline the characteristics that define the database approach.

Database System Concepts and Architecture

- Differentiate between data models, schemas, and instances, using examples where applicable.
- Explain the concept of three-schema architecture and how it achieves data independence.
- Compare and contrast centralized and client/server architectures for DBMSs.
- Classify different types of database management systems based on their characteristics and functionalities.

- **Specific Resources:**
  - Fundamentals ofDatabase System, Esraa Adnan Hadi. https://www.researchgate.net/publication/336472480_Fundamentals_of_Database_System
  - Fundamentals of Database Systems Fourth Edition, Ramez Elmasri Department of Computer Science Engineering University of Texas at Arlington, Shamkant B. Navathe College of Computing Georgia Institute of Technology.

https://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/Database_Systems.pdf

Unit – 2 : Relational Model (12Hrs)

Introduction to relational model, Codd's rules, concepts of domain, attribute, tuple, relation, constraints (Domain, Key constraints, integrity constraints) and their importance , concept of keys (super key, candidate key, primary key, surrogate key, foreign key) , relational Algebra & relational calculus.

Normalization: Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), Boyce-codd normal form(BCNF)

- **Description:**
  This unit focuses on principles and techniques essential for structuring relational databases. It begins with understanding functional dependencies and progresses through normalization processes from First Normal Form (1NF) to Fifth Normal Form (5NF) and Boyce-Codd Normal Form (BCNF). The unit also covers advanced topics such as

  handling multivalued and join dependencies to optimize database design for data integrity and query efficiency in various application domains.

- **Learning Outcomes:**

Demonstrate proficiency in identifying functional dependencies, applying normalization techniques (1NF to 5NF), and understanding algorithms for handling multivalued and join dependencies in relational database design

- **Exercises:**
  - The marketing company wishes to computerize their operations by using following tables:
    CLIENT_MASTER (Client_No, Name, Address1, Address2, City, State, Pincode, Bal_Due)
    PRODUCT_MASTER (Product_No, Description, Profit_Percent, Unit_Measure, Qty_On_Hand, Reorder_Lvl, Sell_Price, Cost_Price)

SALESMAN_MASTER (Salesman_No, Name, Address1, Address2, City, State, Pincode, Sal_Amt, Target_Amt, Remarks)
SALES_ORDER(S_Order_No, S_Order_Date, Client_No, Delve_Address, Salesman_No,Delve_Type, Billed_Yn, Delve_Date, Order_Status)
SALES_ORDER_DETAILS (S_Order_No, Product_No, Qty_Ordered, Qty_Disp, Product_Rate)
CHALLAN_MASTER (Challan_No, S_Order_No, Challan_Date, Billed_Yn)
CHALLAN_DETAILS (Challan_No, Product_No, Qty_Disp)

- **Learning Outcomes:**
  - Proficient in using the Entity-Relationship (ER) model for high-level conceptual data modeling and implementing the Relational Data Model to design schemas, enforce constraints, manage updates, transactions, and handle constraint violations effectively in databases.
- **Specific Resources:**
  - Data Models, geeksforgeeks, https://www.geeksforgeeks.org/data-models-in-dbms/
  - "Understanding SQL and Relational Databases" by Cristian Darie, Karli Watson, Chris Hart, Kevin Hoffman & Julian Skinner. https://link.springer.com/chapter/10.1007/978-1-4302-0800-6_1

Unit – 3 : Entity Relationship Model: (12Hrs)

Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams

BASIC SQL: Database schema, data types, DDL operations (create, alter, drop, rename), DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, aggregation, grouping, ordering.

- **Description:**
  This unit covers Entity-Relationship (ER) modeling for database design, emphasizing entity types, attributes, keys, and weak entity types. It also explores the Relational Data Model, including schema concepts, constraints, update operations, transactions, and managing constraint violations.

- **Learning Outcomes:**
  - Proficient in using the Entity-Relationship (ER) model for high-level conceptual data modeling and implementing the Relational Data Model to design schemas, enforce constraints, manage updates, transactions, and handle constraint violations effectively in databases.

Exercises:

- An enterprise wishes to maintain a database to automate its operations. Enterprise divided into two certain departments and each department consists of employees. The following two tables describes the automation schemas:
  DEPT (Deptno, Dname, Loc)
  EMP (Empno, Ename, Job, Mgr, Hiredate, Sal, Comm, Deptno)
- Design an ER diagram for a hospital management system that includes entities like patients, doctors, and appointments, with appropriate attributes and relationships.
- Identify and define entity types and attributes for a university database system that manages students, courses, and enrolment

- **Specific Resources:**

- "Understanding SQL and Relational Databases" by Cristian Darie, Karli Watson, Chris Hart, Kevin Hoffman & Julian Skinner. https://link.springer.com/chapter/10.1007/978-1-4302-0800-6_1

Unit – 4: SQL (12Hrs)

Nested queries/ sub queries, implementation of different types of joins, SQL functions(Date, Numeric, String, Conversion functions), Creating tables with relationship, implementation of key and integrity constraints, views, relational set operations , Transaction Control Language: commit, Rollback, Savepoint , DCL :Grant, Revoke

- **Description:**
  This unit delves into advanced topics in relational database theory, focusing on the fundamental operations of relational algebra and calculus, including unary and binary relational operations. It also covers SQL standards, providing an in-depth understanding of schema definition, constraints, queries, and views, as well as data manipulation through INSERT, DELETE, and UPDATE statements. The purpose is to equip learners with the knowledge to design, query, and manage relational databases effectively.
- **Learning Outcomes:**
  Apply advanced relational algebra and calculus operations to database queries and design, implement, and manage complex schemas, constraints, and data manipulations using SQL-99 standards.

Exercises:

- List the products which have highest sales.
- Find out the details of top 5 earners of company.
- Determine the names of employee, who earn more than their managers.
- Find the names of clients who have placed orders worth of Rs. 10,000/- or more.
- Determine the names of employees, who take highest salary in their departments.
- Find the names of clients who have placed orders before the month of may 2006.
- Find the customer names and address for the clients, who placed the order '019001'.
- Display names of the managers who is having maximum number of employees working under him.
- Create a view, which contain employee names and their manager names working in sales department.
- Find out if the product is '1.44 drive' is ordered by any client and print the client number, name to whom it is sold.
- Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN)
- Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS
  Ex: Select roll number, name of the student who secured fourth rank in the class.
- Queries (along with sub Queries) using UNION, INTERSECT
- (i) Create a user (ii) Create an varray, which holds the employee phone numbers
- (i) Grant Privileges on Tables (ii) Revoke Privileges from Tables

- **Learning Outcomes:**
  Apply advanced relational algebra and calculus operations to database queries and design, implement, and manage complex schemas, constraints, and data manipulations using SQL-99 standards.
- **Specific Resources:**
  - G. Ozsoyoglu, Z. M. Ozsoyoglu and V. Matos, "Extending relational algebra and relational calculus with set-valued attributes and aggregate functions", https://dl.acm.org/doi/10.1145/32204.32219
  - Jan L. Harrington, "SQL Clearly Explained".

https://www.sciencedirect.com/science/article/abs/pii/B9780123756978500017?via%3Dihub

Unit – 5 : PL/SQL (12Hrs)

Introduction , Structure , Control Structures , Cursors , Procedure , Function , Packages , Exception Handling ,Triggers.

- **Description:**

This unit helps to understand the basics of programming and database management, laying the groundwork for more complex concepts.

- **Learning Outcomes:**

These concepts form the basis of PL/SQL programming, allowing you to write efficient and effective database applications

- **Exercises:**
  - (i) Lock table in share mode (ii) Lock table in Exclusive mode
  - Create a trigger to insert information about the transaction of a customer table. The customer table consists of custno, custname, and money. The information table consists of message field.
  - Design a banking application that handles transactions (e.g., deposits, withdrawals) using the Two-Phase Commit Protocol to ensure data consistency across distributed databases.
  - Implement a simple online shopping cart system where transactions (e.g., adding items, updating quantities, checkout) are managed, ensuring atomicity and isolation properties.
- **Specific Resources:**
  - Dardina Tasmere, Senior Lecturer, Department of Computer Science and Engineering, Bangladesh Army University of Engineering & Technology, Natore, Bangladesh, Md. NazmusSalehinB.Sc Student, Department of Computer Science and Engineering, Bangladesh Army University of Engineering & Technology, Natore, Bangladesh, "Concurrency Control in Database Systems" https://www.cribfb.com/journal/index.php/BJMSR/article/view/365

Text Books:

1. Raghurama Krishnan, Johannes Gehrke, 2003, Database Management Systems, 3rd Edition, TMH
2. Silberschatz, Korth, 2005, Database System Concepts, 5th edition, TMH

References:

[1] Abraham Silberschatz, Henry F. Korth, S. Sudarshan, (2006), *Database System Concepts.* (6th Ed.) McGraw hill.
[2] Peter Rob, A. Anand Rao, Carlos Coronel, *Database Management Systems*. Cengage Learning
[3] Raghu Ramakrishnan, (2015), *Database Management Systems.* (4th Ed) McGraw-Hill.
[4] Peter Rob & Carlos Coronel, (2008), *Database System Concepts.* Cengage Learning.
[5] **Web Resources:**
[6] **[1]** Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 2013,**"Database System Concepts"**, (6th Edition), McGraw hill,
[7] https://www.amazon.in/Database-System-Concepts-Abraham-Silberschatz/dp/9332901384
[8] **[2]** Elmasri and Navathe : Fundamentals of Database Systems,
[9] https://edurev.in/p/97587/Fundamentals-of-Database-Systems-by-Elmasri--Navat,
[10] https://www.amazon.in/Fundamentals-Database-Systems-Elmasri-Shamkant/dp/B076K8CM55

[11] [3] P .S. Gill, Database Management System,
[12] https://www.amazon.in/Database-Management-Systems-P-Gill-ebook/dp/B01GUZBN9K, https://books.google.co.in/books?id=mK4COraJvlIC&printsec=copyright&redir_esc=y#v=onepage&q&f=false
[13] [4] Raghu Ramakrishan, Database Management System,
[14] https://www.amazon.in/Database-Management-Systems-Raghu-Ramakrishnan/dp/0072465638,
[15] https://xuanhien.wordpress.com/wp-content/uploads/2011/04/database-management-systems-raghu-ramakrishnan.pdf

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23BCMAL232: Database Management Systems**
Offered to:	**B. C. A HONS**
Category: Major Theory	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

1. a) What are the differences between data and information. (K1)

(OR)

b) Write a short note on evolution of data models. (k2)

2. a) Explain different types of attributes with neat diagrams. (k2)

(OR)

b) Explain about different keys in dbms? (k2)

3. a) Explain about Integrity rules (k2)

(OR)

b) Write about CODD'S rules? (k2)

4. a) Explain different types of Aggregate functions in SQL. (k2)

(OR)

b) Write a short note on string functions in SQL. (k2)

5. a) Explain Structure of PL/SQL (k2)

(OR)

b) Explain Functions in PL/SQL (k2)

Section B: Long Answer Questions (50 Marks)

Answer All questions. Each question carries 10 Marks.

6. a) Explain the role and advantages of DBMS? (k2)

(OR)

b) Explain briefly about degrees of data abstraction? (k2)

7.a) Explain Specialization hierarchy with an example? (k2)

(OR)

b). Explain Entity Relationship diagram with an example (k2)

8. a) Write a short note on relational set operators. (k2)

(OR)

b) What is normalization? Explain with an example upto 3NF? (k1)

9. a) Explain DDL, DML, DCL commands in SQL with example (k2)

(OR)

b). Explain views in SQL with syntax and examples. (k2)

10. a) Discuss about iterative control statements available in PL/SQL with syntax and examples.(k3)

(OR)

b). Explain types of Triggers in PL/SQL (k3)

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