



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Computer Applications

Level: Under Graduate

Course / Subject Code : BC02001021

Course / Subject Name : Database Management System

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Core Courses

Prerequisite:	Basic knowledge of working with computers
Rationale:	<ul style="list-style-type: none">To understand the fundamental concepts of Database Management Systems.To understand the concepts necessary for designing, using and implementing database systems and applications

Course Outcome:

After completion of the course, student will able to:

No.	Course Outcomes	RBT Level*
1	Describe the core concepts of DBMS & Differentiate various database architectures	UN
2	Analyze database model and Design relational database using E-R model and UML Classes	AP
3	Normalize schema relations up to 4NF using concepts of functional dependency	AP
4	Perform various relational algebra operations on various relational model/database	AP
5	Develop transaction schedules to ensure recoverability and serializability in database systems, applying the principles of transaction properties to maintain data consistency and integrity in real-world scenarios.	AP

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks		
L	T	PR		Theory		Tutorial / Practical				
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)			
3	0	2	4	70	30	20	30	150		

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	Introduction to Database System Database and Users: Introduction (Basic Concepts: Data, Database, Database systems, Database Management Systems), Characteristics of	8	15%



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	Database Approach, Actors on Scene, Workers behind the Scene, Advantages of using the DBMS approach Database System Concepts and Architecture: Data Models, Schemas, Instances, the three schema architectures and data independence, Database Languages and interfaces, Database System environment, Centralized and client / Server Architecture for DBMS, Classifications of Database Management Systems.		
2	Entity Relationship Diagram Using high level conceptual data models for database design (Design Phases of database design), Entity types, Entity Sets, Attributes and keys, Relationship Types, Relationship sets, Roles and structural constraints, Weak entity Types, Refining the ER diagram for company Database, Entity Relationship Diagram Naming conventions Design issues, Example of other Notation: UML class diagram, Relationship types of degree higher than 2 Subclasses, Super Classes, Inheritance Specialization and Generalization Relational Database design by ER and EER to Relational Mapping	2	20%
3	Database Design Informal Design Guidelines for Relational Schema, Functional Dependencies, Normal Forms based on Primary keys, General definitions of 1NF, 2NF and 3NF, Boyce-Codd Normal Forms (BCNF), Multi-valued Dependency and Fourth Normal Form.	12	25%
4	Relational Model concepts: Relational Model concepts, Relational Model constraints and Relational Database Schemas Relational Algebra: Unary Relational Operations (Select and Project), Relational Algebra operations from Set Theory, Binary Relational Operations (JOIN and Division) and Additional Relational Operations (Generalized projection, aggregate functions and grouping, Recursive Closure Operations, Outer Join Operations, the outer union operation).	10	25%
5	Introduction to Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing Schedule Based on Recoverability and Serializability.	12	15%
	Total Hours:	45	100%

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
20%	30%	50%	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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References/Suggested Learning Resources:

(a) Textbook:

1. Ramez Elmsari, Shamkant B Navathe, "Fundamentals of Database Systems", Pearson Education, 7th Edition.
2. Alexis Leon, Mathews Leon, "Essentials of Database Management Systems" (Second reprint 2009), Tata McGraw Hill Publication.

Reference Books:

1. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems" 8 th Edition (2006), Pearson Education
2. Silberschatz, Korth, Sudarshan, "Database System Concepts" 5 th Edition, McGraw Hill
3. S. K. Singh, "Database Systems: Concepts, Design and Applications", Pearson Education
4. ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition
5. Ramakrishnan, Gehrke, "Database Management Systems" 3rd Edition, McGraw Hill
6. Peter Rob, Carlos Coronel, "Database Systems: Design, Implementation and Management", 7th Edition (2007), Cengage Learning

Suggested Course Practical List:

Tools: MySQL (any variant of MySQL like Maria DB etc.)

Topics:

1	Introduction to Database: MySQL, Installation, Data Types
2	Manage Database: Create Database, Drop Database, Select Database (MySQL> prompt)
3	Create Table: The Create Table Command, Creating a table from a table (with data, without data, with all columns, with selected columns) Drop Table Alter Table
4	Study DML Commands (Select, insert, update, delete)
5	Sorting Data, Handling Null values (IS NULL)
6	Join
7	Like Clause , REGEXP
8	Transaction Control statements: Commit, Rollback
9	Advanced Concepts: View, Index, Sequences
10	Database Export / Import
11	Study single row functions: String functions, Numeric Functions, Date Functions
12	Study aggregate / group functions
13	Study sub query concepts



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14	Constraints: Primary Key, Foreign Key, Check, Default, Not Null, Unique
15	Set Operators
16	Compound Statement Handling: Syntax, Variables, flow of control, condition handling, Cursor Management, Create procedure and Function
17	Create Triggers
18	Data dictionary
19	Security / privileges (Desirable)

References:

1. Steve Suehring, Tim Converse, Joyce Park, PHP 6 and MySQL Bible, Wiley
2. Andrea Tarr, PHP and MySQL 24-Hour Trainer, Wiley

Practicals to perform: (SQL and PL/SQL)

Set 1

DEPARTMENT (dept_no, dept_name, location)

1. Create the Simple DEPARTMENT Table.
2. Display structure of department table.
3. Insert below records into Department Table

Dept_no	Dept_name	Location
10	Account	NY
20	HR	NY
30	Production	DL
40	Sales	NY
50	EDP	MU
60	TRG	
110	RND	AH

4. Display all records of Department table
5. Display all department belonging to location 'NY'
6. Display details of Department 10
7. List all department names starting with 'A'
8. List all departments whose number is between 1 and 100
9. Delete 'TRG' department
10. Change department name 'EDP' to 'IT'



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Set 2

EMPLOYEE (emp_id, emp_name, birth_date, gender, dept_no, address, designation, salary, experience, email)

DEPARTMENT (dept_no, dept_name, location)

Do as directed:

Create the EMP Table with all necessary constraints such as In EMP TABLE: Employee id should be primary key, Department no should be Foreign key, employee age (birth_date) should be greater than 18 years, salary should be greater than zero, email should have (@ and dot) sign in address, designation of employee can be “manager”, “clerk”, “leader”, “analyst”, “designer”, “coder”, “tester”.

1. Create DEPT table with neccessary constraint such as
2. Department no should be primary key, department name should be unique.
3. After creation of above tables, modify Employee table by adding the constraints as
4. ‘Male’ or ‘Female’ in gender field and display the structure.
5. Insert proper data (at least 5 appropriate records) in all the tables.
6. Describe the structure of table created
7. List all records of each table in ascending order.
8. Delete the department whose loction is Ahmedabad.
9. Display female employee list
10. Display Departname wise employee Names
11. Find the names of the employee who has salary less than 5000 and greater than 2000.
12. Display the names and the designation of all female employee in descending order.
13. Display the names of all the employees who names starts with ‘A’ ends with ‘A’.
14. Find the name of employee and salary for those who had obtain minimum salary.
15. Add 10% raise in salary of all employees whose department is ‘IT’.
16. Count total number of employees of ‘IT’ department.
17. List all employees who born in the current month.
18. Print the record of employee and dept table as “Employee works in department ‘MBA’”.
19. List names of employees who are fresher’s (less than 1 year of experience).
20. List department wise names of employees who has more than 5 years of experience.
21. Crete Sequence to generate department ID
22. List department having no employees

Set 3

Create the following table:

Salesmen table (SNUM, SNAME , CITY , COMMISSION)

Customers (CNUM, CNAME , CITY , RATING , SNUM)

Orders (ONUM, AMOUNT, ODATE, CNUM, SNUM)



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SNUM : A unique number assigned to each salesman. SNAME : The name of salesman.

CITY : The location of salesmen. COMMISSION: The Salesmen's commission on orders

CNUM : A unique number assigned to each customer. CNAME : The name of the customer. CITY :

The location of the customer. RATING : A level of preference indicator given to this customer.

SNUM : The number of salesman assigned to this customer.

ONUM : A unique number assigned to each order. AMOUNT : The amount of an order. ODATE : The date of an order. CNUM : The number of customer making the order. SNUM : The number of salesman credited with the sale.

Do as directed:

1. Write an Insert script for insertion of rows with substitution variables and insert appropriate data.
2. Produce the order no, amount and date of all orders.
3. Give all the information about all the customers with a specific salesman number.
4. Display the following information in the order of city, sname, snum and commission.
5. List of rating followed by the name of each customer in particular one city e.g. Surat.
6. List of snum of all salesmen with orders in order table without any duplicates.
7. List of all orders for more than certain amount e.g. more than Rs. 1000.
8. List of names and cities of all salesmen in one city e.g. London with commission above 10%.
9. List all customers whose names begins with a letter 'C'.
10. List all customers whose names begins with letter 'A' to 'G'.
11. List all orders with zero or NULL amount.
12. Find out the largest orders of salesman from two value e.g. 1002 and 1007.
13. Count all orders of particular date e.g. October 3, 2023
14. Calculate the total amount ordered.
15. Calculate the average amount ordered.
16. Count the no. of salesmen currently having orders.
17. List all salesmen with their % of commission.
18. Assume each salesperson has a 15% commission. Write a query on the order table that will produce the order number, salesman no and the amount of commission for that order
19. Find the highest rating in each city in the form : For the city (city), the highest rating is : (rating)
List all in descending order of rating.
20. Calculate the total of orders for each day and place the result in descending order.
21. Show the name of all customers with their salesman's name.
22. List all customers and salesmen who shared a same city.
23. List all orders with the names of their customer and salesman.
24. List all orders by the customers not located in the same city as their salesman.
25. List all customers serviced by salespeople with commission above 15%.
26. Calculate the amount of the salesman commission on each order by a customer with rating above 100.



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27. Find all pairs of customers having the same rating without duplication.
28. List all orders that are greater than the average of October 4,2023.
29. Find the average commission of salesmen in London.
30. Find all orders attributed to salesmen in 'London' using both the subquery and join methods.
31. List the commission of all salesmen serving customers in 'London'.
32. Find all customers whose cnum is e.g. 1000 above than the snum of name e.g. Sejal.
33. Count the no. of customers with the rating above than the average of one city e.g. 'Surat'.
34. Find all salesmen with customers located in their cities using ANY and IN.
35. Find all salesmen for whom there are customers that follow them in alphabetical order.
36. Find all customers having rating greater than any customer in particular city e.g. 'Rajkot'.
37. List all orders that has amount greater than atleast one of the orders from 6th October, 2023.
38. Find all orders with amounts smaller than any amount for a customer in 'London'.
39. Find all the customers who have greater rating than every customer in one city e.g. 'Anand'
40. Create a union of two queries that shows the names, cities and ratings of all customers. Those with rating of ≥ 200 should display 'HIGH RATING' and those with < 200 should display 'LOW RATING'.
41. Produce the name and number of each salesman and each customer with more than one current order in the alphabetical order of names.
42. Create union of three queries. First select snum of all salesman in Surat, second, the cnum of all customers in 'Surat' and third, the onum of all orders of 3rd Oct. Retain duplicates between the last two queries but remove the duplicates between either of them and the first.
43. Remove all orders from customer Chirag from the orders table.
44. Set the ratings of all the customers of Piyush to 400.
45. Increase the rating of all customers in Rome by 100.

Set 4

- a) Write a PLSQL block which will print Employee list (Empno and Name) EMP (empno, emppnm, empadd, salary, date_birth, joindt, deptno)
- b) Write a function that returns total number of incomplete jobs, using table JOB (jobid, type_of_job, status)
- c) Write a function which displays the number of items whose weight fall between a given ranges for a particular color using table ITEM (itemno, name, color, weight)
- d) Write a procedure to display top five highest paid workers who are specialized in "PAINTING" using table WORKER (workerid, name, wage_per_hour, specialized_in, manager_id)

Set 5

Create the database EXAM and create given tables with all necessary constraints such as primary key, foreign key, unique key, not null and check constraints.

APPLICANT (AID, ANAME, ADDR, ABIRTH_DT)

ENTRANCE_TEST (ETID, ETNAME, MAX_SCORE, CUT_SCORE)



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ETEST_CENTRE (ETCID, LOCATION, INCHARGE, CAPACITY)

ETEST_DETAILS (AID, ETID, ETCID, ETEST_DT, SCORE)

(This database is for a common entrance test which is being conducted at a number of centers and can be taken by an applicant on any day except holidays)

Do as directed:

1. Modify the APPLICANT table so that every applicant id has an 'A' before its value. E.g. if value is '1123', it should become 'A1123'.
2. Display test center details where no tests were conducted.
3. Display details about applicants who have the same score as that of Ajaykumar in 'ORACLE FUNDAMENTALS'.
4. Display details of applicants who appeared for all tests.
5. Display those tests where no applicant has failed.
6. Display details of entrance test centers which had full attendance between 1st Oct 15 and 15th Oct 16.
7. Display details of the applicants who scored more than the cut score in the tests they appeared in.
8. Display average and maximum score test wise of tests conducted at Mumbai.
9. Display the number of applicants who have appeared for each test, test center wise.
10. Display details about test centers where no tests have been conducted.
11. For tests, which have been conducted between 2-3-17 and 23-4-17, show details of the tests as well as the test centre.
12. How many applicants appeared in the 'ORACLE FUNDAMENTALS' test at Chennai in the month of February?
13. Display details about applicants who appeared for tests in the same month as the month in which they were born.
14. Display the details about APPLICANTS who have scored the highest in each test, test centre wise.
15. Design a read only view, which has details about applicants and the tests that he has appeared for.
16. Write a procedure which will print maximum score centre wise.
17. Write a procedure which will print details of entrance test showing Centre name, candidate id, date, and score:
18. Write a trigger which do not allow insertion / updation / deletion of Enterance test details on Sunday.

Set 6

EMP (empno, empnm, empadd, salary, date_birth, joindt, deptno)

DEPT (deptno, deptnm)

Write a PL/SQL block (table above EMP-DEPT table) which takes as input Department name and



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displays all the employees of this department who has been working since last five years

Set 7

CUSTOMER (cid, fname, lname, city, country, phone)

ORDER (oid, oDate, oNumber, cid, oTotalAmount)

1. List the number of customers in each country. Only include countries with more than 100 customers.
2. List the number of customers in each country, except China, sorted high to low. Only include countries with 5 or more customers.
3. List all customers with average orders between Rs.5000 and Rs.6500.
4. Create a trigger that executes whenever country is updated in CUSTOMER table.
5. Create a function to return customer with maximum orders.
6. Create a procedure to display month names of dates of ORDER table. The month names should be unique.

Set 8

EMPMAST (empno, name, pfno, empbasic, deptno, designation)

DEPT (DNO, DNAME)

Rules: HRA = 15% of basic

DA = 50% of basic

Medical = 100

PF = 8.33% of basic

Print Salary slip. Design your own format

Learning Resources Required: If Any

- 1) https://onlinecourses.nptel.ac.in/noc24_cs21/preview
- 2) <https://docs.oracle.com/en/database/index.html>
- 3) <https://docs.oracle.com/database/121/SQLRF/toc.htm>
- 4) <https://dev.mysql.com>
- 5) <https://docs.mongodb.com/manual/mongo/>

Additional Exercises: If Any

NoSQL Database (Desirable)

Tools: MongoDB

1	Introduction, Installation
2	Create Database, Drop Database
3	Create Collection, show collection



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4	Insert document, Query Document, Update document, delete document
5	Projection
6	Limiting rows
7	Export and Import

<https://docs.mongodb.com/manual/mongo/>

CO- PO Mapping:

Semester 2	Subject Name: Database Management System										
	POs										
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	2	-	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-
CO4	3	2	3	-	3	-	-	-	-	-	-
CO5	3	2	2	-	2	3	-	-	-	-	-

Legend: '3' for high, '2' for medium, '1' for low and '-' for no correlation of each CO with PO.

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