



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Computer Applications

Level: Post Graduate

Course / Subject Code : MC01094031

Course / Subject Name : Relational Database Management Systems

w. e. f. Academic Year:	2024-25
Semester:	1
Category of the Course:	Core Course

<b>Prerequisite:</b>	Basic knowledge of working with computers
<b>Rationale:</b>	<ul style="list-style-type: none"><li>● To understand the fundamental concepts of Database Management Systems and various types of data models.</li><li>● To understand the concepts necessary for designing, using and implementing database systems and applications</li><li>● To provide database design approaches using E-R model, EER to Relational Mapping and normalization, Clear understanding for the need of a database and uses the database schema.</li><li>● To discuss transaction management and concurrency control, and relational management.</li><li>● To learn various constraints and writing SQL queries.</li></ul>

## 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	Understand
2	Analyze database model and Design relational database using E-R model and UML Classes	Apply
3	Describe functional dependency and Normalize schema relations upto 4NF	Understand, Apply
4	Relate the concept of transaction, concurrency control and recovery in database	Apply
5	Perform DDL and DML SQL queries on schema by enforcing integrity constraints on database	Apply

\*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create



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## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	P	C	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	% of Weightage
1.	<b>Introduction to Database System</b> Database and Users: Introduction (Basic Concepts: Data, Database, Database systems, Database Management Systems), Characteristics of 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.	6	15 %
2.	<b>Entity Relationship Diagram</b> 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, Mapping EER model construct to Relations.	11	25 %
3.	<b>Database Design</b> 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.	11	20 %



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4.	<b>Transaction processing</b> Introduction to Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing Schedules based on recoverability and Serializability Relational Model concepts: Relational Model concepts, Relational Model constraints and Relational Database Schemas.	10	25 %
5 (*)	<b>SQL Concepts:</b> Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Savepoint.	7	15 %
<b>Total</b>		<b>45</b>	<b>100</b>

(\*): Only Higher order questions / application oriented questions to be asked in the theory exam from Unit 5.

## Textbook:

1. Ramez Elmsari, Shamkant B Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition
2. Ivan Bayross, SQL, PL/SQL the Programming Language of Oracle, 4th Edition, BPB Publications

## Reference Books:

1. Silberschatz, Korth, Sudarshan, “Database System Concepts”, McGraw Hill Publication. 5th Edition
2. S. K. Singh, “Database Systems : Concepts, Design and Applications”, Pearson Education
3. Peter Rob, Carlos Coronel, “Database Systems : Design, Implementation and Management”, Cengage Learning
4. C. J. Date, A Kannan, S Swaminathan, “An Introduction to Database Systems”, Pearson Education, 8<sup>th</sup> Edition
5. Steve Suehring, Tim Converse, Joyce Park, PHP 6 and MySQL Bible, Wiley

## Suggested Course Practical List:

### RDBMS (Module Weightage: 100%)

**Tools:** Oracle 10g or above



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## Topics:

1	Data Types
2	Study of DDL Commands ( Create , Alter , drop ) 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, Renaming Tables
3	Study DML Commands ( Select, insert, update, delete )
4	Constraints: Defining integrity constraints using create table and the alter table command, Dropping integrity constraints in the alter table command
5	Transaction Control statements: Commit, Rollback
6	Advanced Concepts: View, Index, Sequences, rowid, rownum, Default Value Concept
7	Join (Inner Join, Equi Joins, Self Join, Outer Joins)
8	Study subquery concepts
9	Set Operators
10	Study single row functions: String functions, Numeric Functions, Date Functions, Date Conversion Functions
11	Study aggregate / group functions, having
12	Sorting Data, Handling Null values ( IS NULL), Like Clause
13	Basic concepts of PL/SQL
14	Create Triggers
15	Data dictionary
16	Procedure, function, package
17	<b>Desirable</b> : Security / privileges

## 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



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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'

## 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:

1. 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”.
2. Create DEPT table with necessary constraint such as
3. Department no should be primary key, department name should be unique.
4. After creation of above tables, modify Employee table by adding the constraints as
5. ‘Male’ or ‘Female’ in gender field and display the structure.
6. Insert proper data (at least 5 appropriate records) in all the tables.
7. Describe the structure of table created
8. List all records of each table in ascending order.
9. Delete the department whose location is Ahmedabad.
10. Display female employee list
11. Display Department wise employee Names
12. Find the names of the employee who has salary less than 5000 and greater than 2000.
13. Display the names and the designation of all female employee in descending order.
14. Display the names of all the employees whose names start with ‘A’ ends with ‘A’.
15. Find the name of employee and salary for those who had obtained minimum salary.
16. Add 10% raise in salary of all employees whose department is ‘IT’.
17. Count total number of employees of ‘IT’ department.



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18. List all employees who born in the current month.
19. Print the record of employee and dept table as “Employee works in department ‘MBA’.
20. List names of employees who are fresher’s (less than 1 year of experience).
21. List department wise names of employees who has more than 5 years of experience.
22. Create Sequence to generate department ID
23. 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)

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.



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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)
20. List all in descending order of rating.
21. Calculate the total of orders for each day and place the result in descending order.
22. Show the name of all customers with their salesman's name.
23. List all customers and salesmen who shared a same city.
24. List all orders with the names of their customer and salesman.
25. List all orders by the customers not located in the same city as their salesman.
26. List all customers serviced by salespeople with commission above 15%.
27. Calculate the amount of the salesman commission on each order by a customer with rating above 100.
28. Find all pairs of customers having the same rating without duplication.
29. List all orders that are greater than the average of October 4,2023.
30. Find the average commission of salesmen in London.
31. Find all orders attributed to salesmen in 'London' using both the subquery and join methods.
32. List the commission of all salesmen serving customers in 'London'.
33. Find all customers whose cnum is e.g. 1000 above than the snum of name e.g. Sejal.
34. Count the no. of customers with the rating above than the average of one city e.g. 'Surat'.
35. Find all salesmen with customers located in their cities using ANY and IN.
36. Find all salesmen for whom there are customers that follow them in alphabetical order.
37. Find all customers having rating greater than any customer in particular city e.g. 'Rajkot'.
38. List all orders that has amount greater than atleast one of the orders from 6th October, 2023.
39. Find all orders with amounts smaller than any amount for a customer in 'London'.
40. Find all the customers who have greater rating than every customer in one city e.g. 'Anand'
41. Create a union of two queries that shows the names, cities and ratings of all customers. Those with rating of  $\geq 200$  should display 'HIGH RATING' and those with  $< 200$  should display 'LOW RATING'.
42. Produce the name and number of each salesman and each customer with more than one current order in the alphabetical order of names.
43. 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.
44. Remove all orders from customer Chirag from the orders table.
45. Set the ratings of all the customers of Piyush to 400.
46. Increase the rating of all customers in Rome by 100.





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## **Set 4**

- Write a PLSQL block which will print Employee list (Empno and Name) EMP (empno, empnm, empadd, salary, date\_birth, joindt, deptno)
- Write a function that returns total number of incomplete jobs, using table JOB (jobid, type\_of\_job, status)
- 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)
- 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)

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:

- 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'.
- Display test center details where no tests were conducted.
- Display details about applicants who have the same score as that of Ajaykumar in 'ORACLE FUNDAMENTALS'.
- Display details of applicants who appeared for all tests.
- Display those tests where no applicant has failed.
- Display details of entrance test centers which had full attendance between 1st Oct 15 and 15th Oct 16.
- Display details of the applicants who scored more than the cut score in the tests they appeared in.
- Display average and maximum score test wise of tests conducted at Mumbai.
- Display the number of applicants who have appeared for each test, test center wise.
- Display details about test centers where no tests have been conducted.
- 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.
- How many applicants appeared in the 'ORACLE FUNDAMENTALS' test at
- Chennai in the month of February?





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14. Display details about applicants who appeared for tests in the same month as the month in which they were born.
15. Display the details about APPLICANTS who have scored the highest in each test, test centre wise.
16. Design a read only view, which has details about applicants and the tests that he has appeared for.
17. Write a procedure which will print maximum score centre wise.
18. Write a procedure which will print details of entrance test showing Centre name, candidate id, date and score:
19. Write a trigger which do not allow insertion / updation / deletion of Entrance 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 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**

EMPMAS (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

## **Set 9**

Consider the Bank schema as



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ACCOUNT (AC\_NO, NAME, AC\_TYPE, BALANCE\_AMT, BALANCE\_DATE)

TRANSACTION (AC\_NO, DATE, TR\_TYPE, AMOUNT, PREV\_BALANCE, REMARK)

Note: 1. AC\_type may be S for saving or C for current, 2. TR\_type may be D for deposit or W for withdrawal.

- Write a procedure to print the Bank Transaction details by passing from and to dates.

## Set 10

Employee (eid, fname, lname, salary)

- Use a Cursor for Loop inside a function to calculate and return total paid salary to all employees by the company.
- Modify the function created above to become a procedure and display the total paid salary from the procedure itself. Instead of calculating for all employees, calculate only for those employees whose name starts from a character passed as parameter to the procedure and hence to the cursor.

## List of Laboratory/ Active Learning Assignment: If any

Consider Leave Management process includes defining the leave types, assigning entitlements and calculating carry over leaves, employees applying for leaves, managers approving or rejecting the leave requests, importing the leave data into payroll for calculations etc.

Prepare Database design presentation which includes:

- Purpose of database
- Find/ Identify Information required for application
- Conceptual Design
- Logical Design
- Physical Design

Apply the concepts learned of conceptual design and logical database design

## Learning Resources Required: If Any

- [https://onlinecourses.nptel.ac.in/noc24\\_cs21/preview](https://onlinecourses.nptel.ac.in/noc24_cs21/preview)
- <https://docs.oracle.com/en/database/index.html>
- <https://docs.oracle.com/database/121/SQLRF/toc.htm>

## 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:

Semester1	Relational Database Management System							
	POs							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-
CO3	3	3	3	3	-	-	-	-
CO4	3	1	2	1	-	-	3	-
CO5	3	3	3	3	-	-	1	-
	3	2.5	2.75	2.25	-	-	2	-

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

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