

# GUJARAT TECHNOLOGICAL UNIVERSITY

## COMPUTER ENGINEERING (07) / INFORMATION TECHNOLOGY (16) / INFORMATION & COMMUNICATION TECHNOLOGY (32)

### DATABASE MANAGEMENT SYSTEMS

**SUBJECT CODE:** 2130703

B.E. 3<sup>rd</sup> Semester

**Type of course:** Compulsory

#### **Prerequisite:**

- (1) Elementary knowledge about computers including some experience using UNIX or Windows.
- (2) Computer Programming & Utilization
- (3) Knowledge about data structures and algorithms, corresponding to the basic course on Data Structures and Algorithms.

**Rationale:** A database management system (DBMS) is designed to manage a large body of information. Data management involves both defining structures for storing information and providing mechanisms for manipulating the information. In addition, the database system must provide for the safety of the stored information, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results due to multiple users concurrently accessing the same data.

Examples of the use of database systems include airline reservation systems, company payroll and employee information systems, banking systems, credit card processing systems, and sales and order tracking systems.

A major purpose of a database system is to provide users with an abstract view of the data. That is, the system hides certain details of how the data are stored and maintained. Thereby, data can be stored in complex data structures that permit efficient retrieval, yet users see a simplified and easy-to-use view of the data. The lowest level of abstraction, the physical level, describes how the data are actually stored and details the data structures. The next-higher level of abstraction, the logical level, describes what data are stored, and what relationships exist among those data. The highest level of abstraction, the view level, describes parts of the database that are relevant to each user; application programs used to access a database form part of the view level.

#### **Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	4	8	70	20	10	20	10	20	150

#### **Contents:**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introductory concepts of DBMS : Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA	02	05

2	Relational Model : Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus	03	10
3	Entity-Relationship model : Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema	04	10
4	Relational Database design : Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1NF, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF, Multi-valued dependency, 4NF, Join dependency and 5NF	05	15
5	Query Processing & Query Optimization : Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views	04	10
6	Transaction Management : Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, , two-phase locking protocol, Isolation, Intent locking	09	20
7	Security: Introduction, Discretionary access control, Mandatory Access Control, Data Encryption	02	05
8	SQL Concepts : 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	10	20
9	PL/SQL Concepts : Cursors, Stored Procedures, Stored Function, Database Triggers	03	05

**Reference Books:**

1. An introduction to Database Systems, C J Date, Addition-Wesley.
2. Database System Concepts, Abraham Silberschatz, Henry F. Korth & S. Sudarshan, McGraw Hill.
3. Understanding SQL by Martin Gruber, BPB
4. SQL- PL/SQL by Ivan bayross

5. Oracle – The complete reference – TMH /oracle press

**Course Outcome:**

After learning the course the students should be able:

1. Evaluate business information problem and find the requirements of a problem in terms of data.
2. Understand the uses the database schema and need for normalization.
3. Design the database schema with the use of appropriate data types for storage of data in database.
4. Use different types of physical implementation of database
5. Use database for concurrent use.
6. Backup data from database.

**List of Practical:**

**1. To study DDL-create and DML-insert commands.**

(i) Create tables according to the following definition.

```
CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5) ,CNAME VARCHAR2(18) , BNAME VARCHAR2(18) , AMOUNT NUMBER(8,2) ,ADATE DATE);
```

```
CREATE TABLE BRANCH(BNAME VARCHAR2(18),CITY VARCHAR2(18));
```

```
CREATE TABLE CUSTOMERS(CNAME VARCHAR2(19) ,CITY VARCHAR2(18));
```

```
CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2));
```

(ii) Insert the data as shown below.

**DEPOSIT**

ACTNO	CNAME	BNAME	AMOUNT	ADATE
100	ANIL	VRCE	1000.00	1-MAR-95
101	SUNIL	AJNI	5000.00	4-JAN-96
102	MEHUL	KAROLBAGH	3500.00	17-NOV-95
104	MADHURI	CHANDI	1200.00	17-DEC-95
105	PRMOD	M.G.ROAD	3000.00	27-MAR-96
106	SANDIP	ANDHERI	2000.00	31-MAR-96
107	SHIVANI	VIRAR	1000.00	5-SEP-95
108	KRANTI	NEHRU PLACE	5000.00	2-JUL-95
109	MINU	POWAI	7000.00	10-AUG-95

**BRANCH**

VRCE	NAGPUR
AJNI	NAGPUR
KAROLBAGH	DELHI
CHANDI	DELHI
DHARAMPETH	NAGPUR
M.G.ROAD	BANGLORE
ANDHERI	BOMBAY
VIRAR	BOMBAY
NEHRU PLACE	DELHI
POWAI	BOMBAY

### **CUSTOMERS**

ANIL	CALCUTTA
SUNIL	DELHI
MEHUL	BARODA
MANDAR	PATNA
MADHURI	NAGPUR
PRAMOD	NAGPUR
SANDIP	SURAT
SHIVANI	BOMBAY
KRANTI	BOMBAY
NAREN	BOMBAY

### **BORROW**

LOANNO	CNAME	BNAME	AMOUNT
201	ANIL	VRCE	1000.00
206	MEHUL	AJNI	5000.00
311	SUNIL	DHARAMPETH	3000.00
321	MADHURI	ANDHERI	2000.00
375	PRMOD	VIRAR	8000.00
481	KRANTI	NEHRU PLACE	3000.00

From the above given tables perform the following queries:

- (1) Describe deposit, branch.
- (2) Describe borrow, customers.
- (3) List all data from table DEPOSIT.
- (4) List all data from table BORROW.
- (5) List all data from table CUSTOMERS.
- (6) List all data from table BRANCH.
- (7) Give account no and amount of depositors.
- (8) Give name of depositors having amount greater than 4000.
- (9) Give name of customers who opened account after date '1-12-96'.

2. **Create the below given table and insert the data accordingly.**

Create Table Job (job\_id, job\_title, min\_sal, max\_sal)

COLUMN NAME	DATA TYPE
job_id	Varchar2(15)
job_title	Varchar2(30)
min_sal	Number(7,2)
max_sal	Number(7,2)

Create table Employee (emp\_no, emp\_name, emp\_sal, emp\_comm, dept\_no)

COLUMN NAME	DATA TYPE
emp_no	Number(3)
emp_name	Varchar2(30)
emp_sal	Number(8,2)
emp_comm	Number(6,1)
dept_no	Number(3)

Create table deposit(a\_no,cname,bname,amount,a\_date).

COLUMN NAME	DATA TYPE
a_no	Varchar2(5)
cname	Varchar2(15)
bname	Varchar2(10)
amount	Number(7,2)
a_date	Date

Create table borrow(loanno,cname,bname,amount).

COLUMN NAME	DATA TYPE
loanno	Varchar2(5)
cname	Varchar2(15)
bname	Varchar2(10)
amount	Varchar2(7,2)

Insert following values in the table **Employee**.

emp_n	emp_name	emp_sal	emp_comm	dept_no
101	Smith	800		20
102	Snehal	1600	300	25
103	Adama	1100	0	20
104	Aman	3000		15
105	Anita	5000	50,000	10
106	Sneha	2450	24,500	10
107	Anamika	2975		30

Insert following values in the table **job**.

job_id	job_name	min_sal	max_sal
IT_PROG	Programmer	4000	10000
MK_MGR	Marketing manager	9000	15000
FI_MGR	Finance manager	8200	12000
FI_ACC	Account	4200	9000
LEC	Lecturer	6000	17000
COMP_OP	Computer Operator	1500	3000

Insert following values in the table **deposit**.

A_no	cname	Bname	Amount	date
101	Anil	andheri	7000	01-jan-06
102	sunil	virar	5000	15-jul-06
103	jay	villeparle	6500	12-mar-06
104	vijay	andheri	8000	17-sep-06

105	keyur	dadar	7500	19-nov-06
106	mayur	borivali	5500	21-dec-06

Perform following queries

- (1) Retrieve all data from **employee, jobs and deposit**.
- (2) Give details of account no. and deposited rupees of customers having account opened between dates **01-01-06 and 25-07-06**.
- (3) Display all jobs with minimum salary is greater than 4000.
- (4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.
- (5) Display employee no,name and department details of those employee whose department lies **in(10,20)**

**To study various options of LIKE predicate**

- (1) Display all employee whose name start with 'A' and third character is ' a'.
- (2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'.
- (3) Display the non-null values of employees and also employee name second character should be 'n' and string should be 5 character long.
- (4) Display the null values of employee and also employee name's third character should be 'a'.
- (5) What will be output if you are giving LIKE predicate as '%\\_%' ESCAPE '\'

**3. To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.**

- (1) List total deposit from deposit.
- (2) List total loan from karolbagh branch
- (3) Give maximum loan from branch vrce.
- (4) Count total number of customers
- (5) Count total number of customer's cities.
- (6) Create table supplier from employee with all the columns.
- (7) Create table sup1 from employee with first two columns.
- (8) Create table sup2 from employee with no data
- (9) Insert the data into sup2 from employee whose second character should be 'n' and string should be 5 characters long in employee name field.
- (10) Delete all the rows from sup1.
- (11) Delete the detail of supplier whose sup\_no is 103.
- (12) Rename the table sup2.
- (13) Destroy table sup1 with all the data.
- (14) Update the value dept\_no to 10 where second character of emp. name is 'm'.
- (15) Update the value of employee name whose employee number is 103.

**4. To study Single-row functions.**

- (1) Write a query to display the current date. Label the column Date

- (2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary
- (3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase
- (4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
- (5) Write a query that produces the following for each employee:  
<employee last name> earns <salary> monthly
- (6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.
- (7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.
- (8) Write a query to calculate the annual compensation of all employees (sal+comm.).

## **5. Displaying data from Multiple Tables (join)**

- (1) Give details of customers ANIL.
- (2) Give name of customer who are borrowers and depositors and having living city nagpur
- (3) Give city as their city name of customers having same living branch.
- (4) Write a query to display the last name, department number, and department name for all employees.
- (5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output
- (6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.
- (7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.
- (8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

## **6. To apply the concept of Aggregating Data using Group functions.**

- (1) List total deposit of customer having account date after 1-jan-96.
- (2) List total deposit of customers living in city Nagpur.
- (3) List maximum deposit of customers living in bombay.
- (4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
- (5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.
- (6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998
- (7) Find the average salaries for each department without displaying the respective department numbers.
- (8) Write a query to display the total salary being paid to each job title, within each department.
- (9) Find the average salaries > 2000 for each department without displaying the respective department numbers.
- (10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.

(11) List the branches having sum of deposit more than 5000 and located in city bombay.

**7. To solve queries using the concept of sub query.**

- (1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT
- (2) Give name of customers who are depositors having same branch city of mr. sunil.
- (3) Give deposit details and loan details of customer in same city where pramod is living.
- (4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.
- (5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000
- (6) Display the last name and salary of every employee who reports to ford.
- (7) Display the department number, name, and job for every employee in the Accounting department.
- (8) List the name of branch having highest number of depositors.
- (9) Give the name of cities where in which the maximum numbers of branches are located.
- (10) Give name of customers living in same city where maximum depositors are located.

**8. Manipulating Data**

- (1) Give 10% interest to all depositors.
- (2) Give 10% interest to all depositors having branch vrce
- (3) Give 10% interest to all depositors living in nagpur and having branch city bombay.
- (4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844's current department number.
- (5) Transfer 10 Rs from account of anil to sunil if both are having same branch.
- (6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.
- (7) Delete depositors of branches having number of customers between 1 to 3.
- (8) Delete deposit of vijay.
- (9) Delete borrower of branches having average loan less than 1000.

9. To apply the concept of security and privileges.

10. To study Transaction control commands

**Open Ended Problem:**

- 1) Develop a Online leave management system, 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.
- 2) Develop a Library management system, where indexing of book according to the author or alphabetical order can be done. Issuing of books to the student can be managed and searching of books.
- 3) Make a SQL data base of student details and collaborate it with student semester performance and display each student performance individually.
- 4) Develop Inventory control and procurements for school management systems. School does have regular purchase of chalk box, chairs, benches etc.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will

allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.