

ITM(SLS) Baroda University
School of Computer Science, Engineering and Technology
B.Tech - Semester III

Course Name-Database Management System

Course Code-C2310C4

Course Type: Core

Teaching Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
3	0	2	5	External	Internal	External	Internal	
				40	60	0	50	150

Preamble-Database Management System or DBMS in short refers to the technology of storing and retrieving users' data with utmost efficiency along with appropriate security measures. It explains the basics of DBMS such as its architecture, data models, data schemas, data independence, E-R model, relation model, relational database design, and storage and file structure and much more.

What is DBMS?

Database Management System (DBMS) is software for storing and retrieving user data while considering appropriate security measures. It consists of a group of programs which manipulate the database. The DBMS accepts the request for data from an application and instructs the operating system to provide the specific data. In large systems, a DBMS helps users and other third-party software to store and retrieve data.

DBMS allows users to create their own databases as per their requirement. The term "DBMS" includes the user of the database and other application programs. It provides an interface between the data and the software application.

Prerequisite: Basic knowledge of Computer Programming

Course Objective:

- To understand the different issues involved in the design and implementation of database system.
- To learn physical and logical database designs, database modelling, relational, hierarchical, and network models.
- To learn to use data manipulation language query, update, and manage a database.
- To understand essential DBMS concepts such as: database security, integrity, concurrency, storage strategies etc.
- The students will get the hands-on practice of using SQL and PL/SQL concepts.

- Design the database schema with the use of appropriate data types for storage of data in database.

Course Learning Outcome:

After completing the course, the student shall be able to :

	Course Outcome	Bloom's Level
CO1	Understand functional components of the DBMS.	Understanding
CO2	Develop Data Models	Applying
CO3	Design queries using Relational Algebra, Relational Calculus and SQL	Evaluation
CO4	Design database schema	Creation
CO5	Evaluate and optimize queries	Evaluation
CO6	Understand transaction processing, concurrency control and recovery techniques	Understanding
CO7	Implementing the SQL Concepts	Evaluation

Course Competency:

1. Understand database concepts and structures and query language
2. Understand the E R model and relational model
3. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
4. Understand Functional Dependency and Functional Decomposition. & apply various Normalization techniques
5. Perform PL/SQL programming using concept of Cursor Management, Error Handling, Package and Triggers
6. Execute various advance SQL queries related to Transaction Processing & Locking using concept of Concurrency control.
7. Understand query processing and techniques involved in query optimization.

Course Contents:

Unit #	Topics (Programs) to be Completed	Hours
1	Database system architecture Introduction to DBMS- Historical perspective, File Versus a DBMS, Advantages of DBMS, Describing and storing data in DBMS, Architecture of a DBMS Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).	5
2	Data models Entity-relationship model, Features of ER Model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	6
3	Relational query languages Relational algebra, Tuple and domain relational calculus and SQL – Queries, Constraints, Form of SQL Query , UNION, INERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null values, Complex Integrity constraints in SQL, triggers and Embedded SQL	4
4	Relational database design Domain and data dependency, Armstrong's axioms, Normal forms-1NF, 2NF, 3NF and BCN. Dependency preservation, Lossless design.	5
5	Query processing and optimization Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	6
6	Transaction processing Concurrency control, ACID property, Serializability of scheduling, Locking and time stamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. Security and Authorization- Access control, Direct access control and Mandatory access control, Role of DBA, Application development.	6
7	SQL Concepts Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, aggregate functions, Built-in functions –numeric, date, string functions, Set operations, sub-queries, correlated sub-queries, join, Exist, Any, All , view and its types., transaction control commands. PL/SQL Concepts : Cursors, Stored Procedures, Stored Function, Database Triggers	13
	Total	45

References:**Text Books :**

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan – Tata McGraw Hill.

Reference Books:

1. Fundamentals of Database Systems by R.Elmasri and S. Navathe – Pearson.
2. An Introduction to Database Systems by C J Dave – Pearson.
3. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2003.
4. SQL- PL/SQL by Ivan bayross.
5. Oracle – The complete reference – TMH /oracle press

Required Software:

1. SQL/PLSQL Supporting Software-Oracle, SQL Server, MySQL

Case Studies:

Sr.No.	Case Studies	Evaluation
C1	Railway Reservation – queries for maintaining database.	<ol style="list-style-type: none"> 1. Identification of algorithm. 2. Report preparation. 3. Presentation with VIVA
C2	Facebook – ER diagram	<ol style="list-style-type: none"> 1. Identification of algorithm. 2. Report preparation. 3. Presentation with VIVA
C3	Search button of facebook – uses which queries.	<ol style="list-style-type: none"> 1. Identification of algorithm. 2. Report preparation. 3. Presentation with VIVA

Simulations/Animation: NA

TEDx Videos:

Sr. No.	Videos
T1	https://www.ted.com/talks/will_marshall_the_mission_to_create_a_searchable_database_of_earth_s_surface - The mission to create a searchable database of Earth's surface – Will MarshallEarth is taken a huge database and using AI to index all the objects on the planet over time- which could make ships, trees, houses and everything else on Earth searchable, the same way you search Google. He shares a vision for how this database can become a living record of the immense physical changes happening across the globe. "You can't fix what you can't see," Marshall says. "

Other Videos:

Sr. No	About Video	Link	Topic
O1.	Stanford Lecture – Jennifer Widom - 05-Jan-2013 – Introduction to Databases	https://www.youtube.com/watch?v=D-k-h0GuFmE&list=PLroEs25KGvwzmVixYHRhoGTz9w8LeXek0	Introduction to Database
O2.	NPTEL – Introduction to SQL/1 – By Prof. Partha Pratim	https://www.youtube.com/watch?v=w1XdPholzWY&list=PL3pGy4HtqwD3Ov1J2UBTfsLgxUzUktAM&index=7	SQL Concepts

	Das – IIT Kharagpur		
O3.	NPTEL – Query Processing and Optimization - By Prof. ParthaPratim Das – IIT Kharagpur	https://www.youtube.com/watch?v=Sn_Wkf9KNEg	Query Processing and Optimization
O4.	CMU Database Systems - 01 Course introduction & Relational Data Model (Fall 2018) – Carnegie Mellon University	https://www.youtube.com/watch?v=vyVGm_2iFwU&list=PLSE8ODhjZXja3hgmuhf89qboV1kOxMx7	Course introduction & Relational Data Model

Related MOOCs courses

1. Data Base Management System By Prof. ParthaPratim Das, Prof.Samiran Chattopadhyay - IIT Kharagpur – NPTEL- 8 weeks course

Activity Based Learning(ABL):

Sr.No	Name of Activity	Details of Activity	Outcome	Evaluation
A1	Describe Basics of PL/SQL	<ul style="list-style-type: none"> • Introduction to PL/SQL will be done. • Installations will be done. 	Students will become familiar with PL/SQL language.	<ul style="list-style-type: none"> • Write queries • Get Output
A2.	Different types of Iteration and looping constructs in PL/SQL	<ul style="list-style-type: none"> • Inner and outer loops with examples. • Use of EXIT statement • Use of CONTINUE statement • Use of GO TO statement 	<p>Students will be able to perform different looping examples.</p> <p>Able to write different queries.</p>	<ul style="list-style-type: none"> • Write queries • Get Output
A3.	Hands On Exercise on Cursor	<ul style="list-style-type: none"> • Learning above implicit and explicit cursors. • Examples based on declaring, opening, fetching and closing 	Students will be able write queries related to cursors.	<ul style="list-style-type: none"> • Write queries • Get Output

		a cursor		
A4.	Hands On Exercise on Stored Procedure	<ul style="list-style-type: none"> • Learning how to create a procedure. • Examples based on procedures 	Students will be able to create procedures and write queries.	<ul style="list-style-type: none"> • Write queries • Get Output

Lab Experiments:

Sr. No.	Experiments	Total Hrs
PS-1	<p>To study DDL-create and DML-insert commands.</p> <ul style="list-style-type: none"> • Create tables according to the following definition. • Insert the data as shown below. • From the above given tables perform the following queries: <ol style="list-style-type: none"> (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 the name of customers who opened account after date '1-12-96'. 	2
PS-2	<p>Create the below given table and insert the data accordingly.</p> <p>Perform following queries.</p> <ol style="list-style-type: none"> (10) Retrieve all data from employee, jobs and deposit. (11) Give details of account no. and deposited rupees of customers having opened account between dates 01-01-06 and 25-7-06. (12) Display all jobs with minimum salary is greater than 4000. (13) Display names and salary of employee whose department no is 20. Give alias name to name of employee. (14) Display employee no, name and department details of those employee whose department lies in (10,20). <p>To study various options of LIKE predicate.</p> <ol style="list-style-type: none"> (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'\'. 	2
PS-3	<p>To perform various data manipulation commands, aggregate functions and sorting concept on all created tables.</p> <ol style="list-style-type: none"> (1) List total deposit from deposit. (2) List total loan from karolbagh branch 	2

	<ul style="list-style-type: none"> (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. 	
PS-4	<p>To study Single-row functions.</p> <ul style="list-style-type: none"> (1) Write a query to display the current 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.). 	2
PS-5	<p>2. Displaying data from Multiple Tables (join)</p> <ul style="list-style-type: none"> (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 	3.

	<p>Employee, Emp#, Manager, and Mgr#, respectively.</p> <p>(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.</p>	
PS-6	<p>4. To apply the concept of Aggregating Data using Group functions.</p> <p>(1) List total deposit of customer having account date after 1-jan-96.</p> <p>(2) List total deposit of customers living in city Nagpur.</p> <p>(3) List maximum deposit of customers living in bombay.</p> <p>(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.</p> <p>(5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.</p> <p>(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</p> <p>(7) Find the average salaries for each department without displaying the respective department numbers.</p> <p>(8) Write a query to display the total salary being paid to each job title, within each department.</p> <p>(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.</p> <p>(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.</p> <p>(11) List the branches having sum of deposit more than 5000 and located in city bombay.</p>	2
PS-7	<p>5. To solve queries using the concept of sub query.</p> <p>(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT</p> <p>(2) Give name of customers who are depositors having same branch city of mr. sunil.</p> <p>(3) Give deposit details and loan details of customer in same city where pramod is living.</p> <p>(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.</p> <p>(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000</p> <p>(6) Display the last name and salary of every employee who reports to ford.</p> <p>(7) Display the department number, name, and job for every employee in the Accounting department.</p> <p>(8) List the name of branch having highest number of depositors.</p> <p>(9) Give the name of cities where in which the maximum numbers of branches are located.</p> <p>(10) Give name of customers living in same city where maximum depositors are located.</p>	2
PS-8	<p>6. Manipulating Data</p> <p>(1) Give 10% interest to all depositors.</p> <p>(2) Give 10% interest to all depositors having branch vrce</p> <p>(3) Give 10% interest to all depositors living in nagpur and having branch city bombay.</p>	2

	(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.	
PS-9	To apply the concept of security and privileges.	1
PS-10	To study transaction control commands.	1
PS-11	Write cursors and triggers.	1

Mini Projects:

Sr.no.	
MP-1	Inventory Control Management Database
MP-2	Student Record Keeping System Database
MP-3	College Student Database System
MP-4	Library Management System
MP-5	Payroll Management Database System