

Code: BCA-3002T (For theory) BCA-3002P (For practical)	CC-VII	Database Management Systems	3L+T:4P	5 Credits (45 hours theory and 9 hours practical)
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Max Marks; Theory: 100 (Int: 25; Ext: 75); Practical: 100

Course Outcomes: Upon completion of the course, students will be able to

- CO 1.** Understanding Core Concepts of DBMS, keys, and ER model
- CO 2.** Proficiency in Database Design and SQL and normalization
- CO 3.** Application of Advanced Database Techniques and transactions
- CO 4.** Knowledge of No SQL database and Big data

Course Outcomes after Lab Programs:

- CO 1.** Understanding Core Concepts of DBMS
- CO 2.** Proficiency in Database Design and SQL
- CO 3.** Application of Advanced Database Techniques Prerequisite:
- CO 4.** Basic knowledge of Set Theory.

Unit	Topics	Proposed Lecture
I	<p>Introduction to Databases: Definition and Importance Of DBMS, History and Evolution of DBMS, Characteristics of DBMS, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators</p> <p>Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-Oriented), Importance of Data Models In DBMS</p> <p>Database Design: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in A Table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema</p>	12
II	<p>Relational Algebra and Calculus: Introduction to Relational Algebra. Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus</p> <p>Structured Query Language (SQL): SQL Basics: DDL And DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical Operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order By, Top/Limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right Outer Join, Equi Join.</p> <p>Advanced SQL: Analytical Queries, Hierarchical Queries, Recursive Queries, Views, Cursors, Stored Procedures and Functions, Packages,</p>	12

	Triggers, Dynamic SQL. Normalization And Database Design: Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.	
III	Transaction Management: Acid Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support In SQL, Introduction to Crash Recovery, 2pl, Serializability, And Recoverability, Introduction to Lock Management, Dealing with Deadlocks Database Storage and Indexing: Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection	11
IV	NoSQL Databases and Big Data: Introduction to NoSQL, Data Models: Document, Key Value, Column Family, Graph. Uses and Features of NO/SQL Document Databases. CAP Theorem, BASE Vs ACID, CRUD Operations, MongoDB Operators, Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra. Database Security and Advanced Topics: Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Ware housing, OLAP, Data Mining	10
Lab Programs	<ol style="list-style-type: none"> 1. Draw an ER Diagram of Registrar Office 2. Draw an ER Diagram of Hospital Management System 3. Reduce the ER diagram in question no1 into tables 4. Reduce the ER diagram of question no2 into tables 5. Consider the following Schema Supplier (<u>SID</u>, Sname, branch, city, phone) Part (<u>PID</u>, Pname, color, price) Supplies (<u>SID</u>, <u>PID</u>, qty, date_supplied) <p>DDL Commands</p> <ol style="list-style-type: none"> 1. Create the above tables 2. Add a new attribute state in supplier table 3. Remove attribute city from supplier table 4. Modify the data type of phone attribute 5. Change the name of attribute city to address 6. Change a table's name, supplier to sup 7. Use truncate to delete the contents of supplies table 8. Remove the part table from database <p>DML Commands</p> <ol style="list-style-type: none"> 1. Insert at least 10 records in tables supplier, part, and supplies 2. Show the contents in tables supplier, part, and supplies 3. Find the name and city of all suppliers 4. Find the name and phone-no of all suppliers who stay in 'Delhi' 5. Find all distinct branches of suppliers 6. Delete the record of the supplier whose SID is 204001 7. Delete all records of supplier table 8. Delete all records of suppliers whose city starts with capital A. 9. Find the supplier names which have 'lk' in any position 10. Find the supplier name where 'R' is in the second position 11. Find the name of supplier whose name starts with 'V' and ends with 'A' 12. Change the city of all suppliers to 'BOMBAY' 13. Change the city of supplier 'Vandana' to 'Goa' <p>Queries with Constraints</p> <ol style="list-style-type: none"> 1. Create the supplier table with Primary Key Constraint 2. Create supplies table with Foreign key Constraint 3. Create a part table with UNIQUE Constraint 4. Create supplier Table with Check Constraints 	

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5. Create Supplier table with Default Constraint Queries on TCL
6. Create Save point
7. Rollback to Save point
8. Use Commit to save on Aggregate Functions:
9. Find the minimum, maximum, average and sum of costs of parts
10. Count the total number of parts present
11. Retrieve the average cost of all parts supplied by 'Mike' Queries on GROUP BY, HAVING AND ORDER BY Clauses
12. Display total price of parts of each color
13. Find the branch and the number of suppliers in that branch for branches which have more than 2 suppliers
14. Find all parts sorted by name in ascending order and cost in descending order
15. Find the branch and the number of suppliers in that branch Queries on Analytical, Hierarchical, Recursive nature.
16. Find out the 5th highest earning employee details.
17. Which department has the highest number of employees with a salary above \$80,000, and what percentage of employees in that department have a salary above \$80,000
18. Retrieve employee table details using the hierarchy query and display that hierarchy path starting from the top level indicating if it is a leaf and there exists a cycle.
19. What is the average salary for employees in the top 2 departments with the highest average salary, and what is the hierarchy of departments and sub-departments for these top 2 departments?
20. Use recursion to retrieve the employee table and display the result in breadth first and depth first order.
21. Write a recursive query to show the equivalent of level, connect_by_root, and connect_by_path.
22. Use recursion to retrieve the employee table and display the result in depth first order showing id, parentid, level, root_id, path and leaf.

Queries on Operators:

6. Find the pname, phoneno and cost of parts which have cost equal to or greater than 200 and less than or equal to 600.
7. Find the sname, SID and branch of suppliers who are in 'local' branch or 'global' branch
8. Find the pname, phoneno and cost of parts for which cost is between 200 and 600
9. Find the pname and color of parts, which has the word 'NET' anywhere in its pname.
10. Find the PID and pname of parts with pname either 'NUT' or 'BOLT'
11. List the suppliers who supplied parts on '1stmay2000', '12JAN2021', '17dec2000', '10 Jan 2021'
12. Find all the distinct costs of parts

Join Operators

13. Perform Inner join on two tables
14. Perform Natural Join on two tables
15. Perform Left Outer Join on tables
16. Perform Right Outer join on tables
17. Perform Full Outer Join on tables Set Theory

Operators

18. Show the use of UNION operator with union compatibility
19. Show the use of Intersect operator with union compatibility
20. Show the use of minus operator with union compatibility
21. Find the Cartesian product of two tables

Queries on Set Theory Operators

22. List all parts except 'NUT' and 'BOLT' in ascending order of costs
23. Display all parts that have not been supplied so far
24. To display the supplier names who have supplied 'green' part with cost 500 Rupees

AND 'red' part with cost 400 Rupees.

25. To display the supplier names who have supplied 'green' part with cost 500 Rupees OR 'red' part with cost 400 Rupees.

26. To Display the name of suppliers who have supplied all parts that are 'red' in color.

PL/SQL Programs

27. Write a PL/SQL Code to add two numbers

28. Write a PL/SQL code for Fibonacci series

29. Write a PL/SQL Code for greatest of 3 numbers

30. Write a PL/SQL code for area and circumference of a circle

PL/SQL Programs on Cursors

31. Write a Program using CURSOR to display SID and city of 1st record of supplier

32. Write a program using cursors to display the SID and City of all suppliers and then print the count of suppliers.

PL/SQL Programs on Triggers, Procedures and Functions

33. Write a Program using TRIGGER on UPDATE

34. Write a command to See the effect of trigger

35. Write a Program using PROCEDURE to increase the cost by Rs.1000 for part whose PID is passed as an argument.

36. Write a procedure to update the city of a supplier whose SID and city are passed as arguments and the procedure returns the name of supplier whose city is updated.

37. Write a function to return the total number of suppliers

38. Write a function to return the PID of part, for which the part name is passed

39. Write a function to find the sum total of costs of all parts.

PL/SQL Programs on Implicit Cursors

40. Insert a record using %ROWTYPE

41. Write a code using %NOTFOUND, %FOUND, %ROWCOUNT

42. Write a code using %TYPE

MongoDB Queries

43. Create a collection and insert documents into it using insertOne() and insertMany()

44. Select all documents in collection

45. Find the count of all suppliers

46. Find all records that have city='Delhi'

47. Retrieve all documents that have color equal to 'red' or 'green'

48. Retrieve all documents where part_name is 'P1' or price is less than 200.

49. Update the record of 'Geeta', set city='Bombay' and phoneno='11223344'

50. Delete all records where price is greater than 5000

51. Display only the name and city of the supplier

52. Sort all suppliers on city and display only the first two records.

Text Books:

1. Ramakrishnan, Raghu, and Johannes Gehrke. *Database Management Systems*. 3rd ed., McGraw-Hill, 2018.

2. Rosenzweig, Benjamin, and Elena Rakhimov. *Oracle PL/SQL by Example*. 5th ed., Prentice Hall, 2015.

3. Dayley, Brad. *NoSQL with MongoDB in 24 Hours*. 1st ed., Sams Publishing, 2024.

4. SQL, PL/SQL The Programming Language of Oracle, Ivan Bayross, BPB Publication

5. C. J. Date, *Introduction to Database System*, Pearson

6. Bipin Desai, "An Introduction to Database System", Galgotia Publication

7. *Fundamentals of Database Systems*, Ramez Elmasri and Shamkant B. Navathe, Addison-Wesley

Reference Books:

1. Korth, Henry F., et al. *Database System Concepts*. 7th ed., McGraw-Hill, 2019.

2. *Oracle SQL&PL/SQL Programming Fundamentals*, Djeni Darmawi karta