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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Computer Science and Engineering **Duration: 3 hrs.**

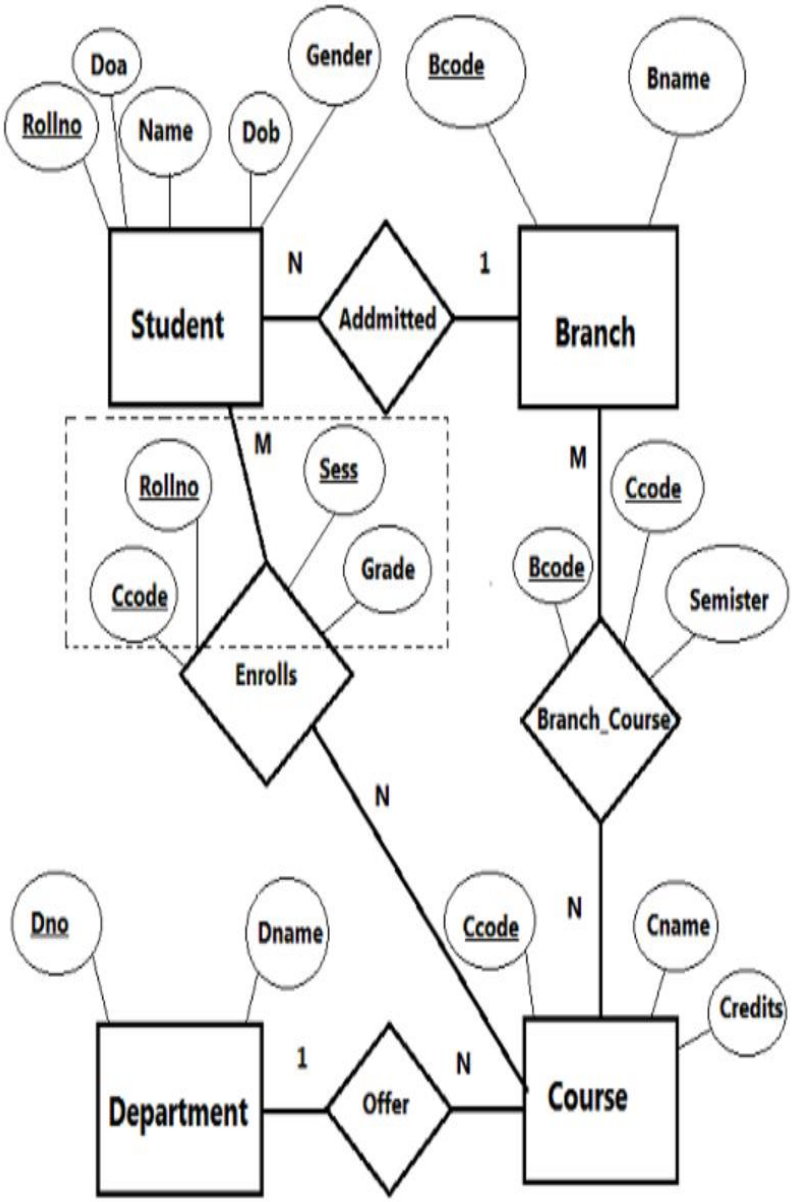
Course Code: 19CS4PCDBM **Max Marks: 100**

Course: Database Management Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Explain the database approach and its advantages over traditional file-based systems. Discuss the characteristics of a Database Management System (DBMS) that make it more efficient for data storage and retrieval.	*CO1*	*PO1*	**10**
	b)		Consider the following relational schema BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Branch_id, No-of_Copies) BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH (Branch_id, Branch_Name, Address) Write SQL queries for the following: i. List all book titles published in the year 2023 ii. Find the total number of copies of a specific book (e.g., "Database Systems") available in all branches iii. Retrieve the names of authors who have written a specific book (e.g., "Machine Learning") iv. Find all books published by a specific publisher (e.g., "Pearson") v. Retrieve the book title, publisher name, and publisher address	*CO2*	*PO2*	**10**
			OR			
2	a)		Describe the architecture of a DBMS with reference to the three-schema model. Explain how data independence is achieved in a DBMS	*CO1*	*PO1*	**10**
	b)		Write a SQL query to create a table with constraints such as primary key, foreign key, and unique. Explain the role of each constraint in maintaining data integrity.	*CO1*	*PO1*	**10**

			UNIT - II			
	3	a)	Consider ER diagram given below and perform the following i. Identify the number of tables are required to implement the below given ER diagram by listing and specifying the reasons for each table. ii. Apply the algorithm to convert the given ER diagram to relational schema  	*CO3*	*PO3*	**10**
		b)	Discuss the difference between one-to-one, one-to-many, and many-to-many relationships in the ER model. Provide examples for each type of relationship	*CO1*	*PO1*	**10**
			OR			
	4	a)	Consider that in an ER diagram, there are three strong entity sets (E1, E2 and E3) and two binary relationship sets (R1 and R2). R1 is a many-to-many relationship between E1 and E2 while R2 is a	*CO2*	*PO2*	**10**

			many-to-one relationship between E2 and E3 (Each entity of E2 can be related to at most one entity of E3 but each entity in E3 can be related to multiple entities in E2). Both the relationships R1 and R2 are partial. You may assume suitable attribute names including key attributes. Considering two or three attributes for each entity set is sufficient. Assume R1 and R2 don't have any attributes. Design a ER diagram based on given requirements			
		b)	Explain the concept of keys in an ER model. What is the difference between a primary key, a composite key, and a candidate key? Provide examples.	*CO1*	*PO1*	**05**
		c)	Define weak entity types in the ER model. What distinguishes a weak entity from a regular entity? Provide an example where a weak entity type is used	*CO1*	*PO1*	**05**
			UNIT - III			
	5	a)	Write relational algebra expressions for the following queries on a database with relations STUDENT(Student_ID, Name, Age, Department) and COURSE(Course_ID, Course_Name, Student_ID) i. Find the names of all students enrolled in a "Database Systems" course. ii. Retrieve all students from the "Computer Science" department. iii. List students who have not enrolled in any course	*CO2*	*PO2*	**5**
		b)	Write general syntax of DIVISION operation w.r.t relational algebra. Find the quotient for the following: A/B1, A/B2 where A, B1, B2 are Relations. A SNO | PNO S1 | P1 S1 | P2 S1 | P3 S2 | P4 S2 | P1 S2 | P2 S3 | P2 S4 | P2 S4 | P4 B1 PNO P2 B2 PNO P2 P4	*CO2*	*PO2*	**5**
		c)	Describe the set-theoretic operations in relational algebra (UNION, INTERSECTION, DIFFERENCE, CARTESIAN PRODUCT). Give examples of each operation	*CO1*	*PO1*	**10**
			OR			
	6	a)	Consider a data base with the following schema	*CO3*	*PO3*	**10**

			Students (ssn, name, address) Course(code, title) Registered(ssn, code) Give the queries in the relational algebra using the relational schema given above: i. List the codes of courses for which no student is registered ii. The titles of courses for which no student is registered. iii. Names of the students and the titles of the courses they have registered iv. SSNs of students who are registered for 'Database Systems' or 'Analysis of Algorithms'. v. List of courses in which all students are registered.			
		b)	Discuss the JOIN operation in relational algebra. Explain different types of joins (Theta Join, Equi-Join, Natural Join, Outer Join) with examples	*CO1*	*PO1*	**10**
			UNIT - IV			
	7	a)	Consider a relation with schema R(A,B,C,D) with functional dependencies (FD's): BC → A, AD → B, CD → B, AC → D. Find all the candidate keys of R	*CO2*	*PO2*	**05**
		b)	Explain First Normal Form (1NF), Second Normal Form (2NF), and Third Normal Form (3NF) with suitable examples	*CO1*	*PO1*	**10**
		c)	Consider the following relation instance **X** | **Y** | **Z** | 1 | 4 | 2 | 1 | 5 | 3 | 1 | 6 | 3 | 3 | 2 | 2 | Given the above relation instance, which of the following dependencies may hold in the above relation? If the dependency cannot hold, explain why by specifying the records that cause the violation. XZ → Y, Z → Y, YZ → X and Y → Z	*CO2*	*PO2*	**05**
			OR			
	8	a)	i. Explain Boyce-Codd Normal Form (BCNF)? How is it different from 3NF? ii. Given a relation R(A, B, C, D) with the functional dependencies	*CO2*	*PO2*	**10**

			{A → B, B → C, C → D}, determine whether R is in BCNF. Justify your answer.			
		b)	Explain the informal design guidelines for relation schemas. Why are these guidelines important in relational database design? Provide examples to illustrate your answer.	*CO1*	*PO1*	**10**
			UNIT - V			
	9	a)	Explain the ACID properties of transactions and their significance in transaction processing.	*CO1*	*PO1*	**05**
		b)	Consider the following transactions and schedule. Construct the dependency graph and determine if the schedule is conflict serializable T1: r1(X), w1(X), r1(Y), w1(Y) T2: r2(X), w2(X), r2(Y), w2(Y) Schedule: r1(X), w1(X), r2(X), w2(X), r1(Y), w1(Y), r2(Y), w2(Y)	*CO2*	*PO2*	**05**
		c)	With neat diagram explain state transition diagram illustrating the states for transaction execution.	*CO1*	*PO1*	**10**
			OR			
	10	a)	Describe the ARIES recovery algorithm and explain how it handles transaction failures efficiently.	*CO2*	*PO2*	**10**
		b)	Determine whether the following schedule is recoverable or non-recoverable. Justify your answer. i. r1(A), w1(A), r2(A), w2(A), c2, a1 ii. r1(X), w1(X), r2(X), w2(X), c1, c2	*CO2*	*PO2*	**05**
		c)	Discuss the importance of transaction logs in recovery. How does logging help in ensuring data consistency?	*CO1*	*PO1*	**05**

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