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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: III**

Branch: CSE (IoT)/AI&DS/CSE(DS) **Duration: 3 hrs.**

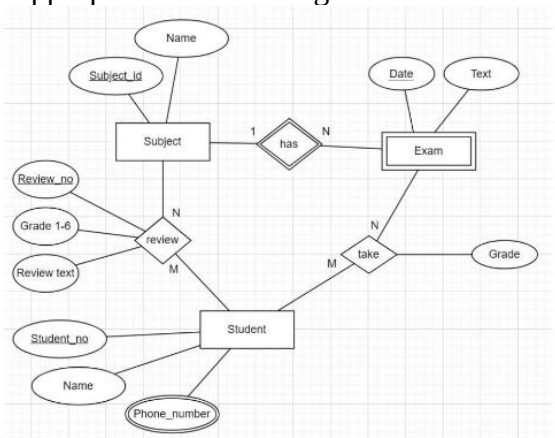
Course Code: 23DC3PCDBM **Max Marks: 100**

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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain the purpose of Three-Schema Architecture with neat diagram and discuss why mappings between these schema levels are essential in a Database Management System (DBMS).	*CO1*	*PO1*	**05**
	b)	Differentiate between View and Table.	*CO2*	*PO2*	**05**
	c)	Given the requirements for a **Customer Orders Database**, complete the following tasks using appropriate SQL DDL and DML statements **a.** Write a SQL statement to create a table called Orders with the following columns: • OrderID: an integer, the primary key. • CustomerID: an integer, referencing the CustomerID column in the Customers table. • OrderDate: a date, indicating when the order was placed. • TotalAmount: a decimal, representing the total cost of the order. **b.** Modify the TotalAmount column in the Orders table to allow for values up to 9,999.99 with two decimal places for precision. **c.** Add a new column Status to the Orders table as a string with a maximum length of 20 characters, and set the default value of this column to 'Pending'. **d.** Insert a record into the Orders table for a new order, using fictitious data that adheres to the table's structure and constraints.	*CO1*	*PO1*	**10**
		OR			
2	a)	Define Databases and DBMS with example. Explain the different characteristics of a Database Management System (DBMS) with examples.	*CO1*	*PO1*	**09**
	b)	Given the schema: Patients(PatientID, Name, Age, Gender, Address) Doctors(DoctorID, Name, Specialization, Department) Appointments(AppointmentID, PatientID, DoctorID,	*CO1*	*PO1*	**11**

			AppointmentDate, Diagnosis) Write a SQL statements for the following requirements. 1. Retrieve the names of all patients who are above 60 years of age. 2. Find the names of doctors who specialize in "Cardiology". 3. List all appointments, including the patient's name, doctor's name, appointment date, and diagnosis. 4. Calculate the total number of appointments each doctor has attended. 5. Identify doctors who have attended more than 10 appointments in the "Orthopedics" department.			
			UNIT - II			
	3	a)	Consider the following set of requirements for a CAR RENTAL database.Design an ER diagram for this application: A database is to be designed for a Car Rental Co. (CRC). The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addressees, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources - car hire, car sales, insurance claims - must be kept of file.CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details (such as name, address, telephone number, driving licence, number) about each customer are kept in the database.	*CO3*	*PO3*	**10**
		b)	Define the following types of attributes in the context of the Entity-Relationship Model with suitable examples: a) Composite Attribute b) Single-Valued Attribute c) Multi-Valued Attribute d) Derived Attribute	*CO1*	*PO1*	**04**
		c)	Analyze how different types of update operations (INSERT, DELETE, and UPDATE) can lead to violations of integrity constraints in relational databases. Justify your answer with suitable example	*CO2*	*PO2*	**06**

			OR			
	4	a)	Define the following terms related to the Entity-Relationship Model with suitable examples: a) Strong Entity b) Weak Entity c) Primary Key d) Candidate Key e) Foreign Key	*CO1*	*PO1*	**05**
		b)	Analyze the provided ER diagram and Translate the ER diagram into appropriate schema diagram.  	*CO2*	*PO2*	**05**
		c)	Consider the following schema for the BANK database. Write the queries in Relational Algebra? BRANCH(BranchId, Bname, City,Phone) Account(AccountNo, Aname,Atype,BranchId,Balance) Transaction(TID,T_Date,T_Type,AccountNo,Amount) a) Retrieve ID and name of all the branches located in Surat city. b) Retrieve ID, type and amount of all transactions of withdrawal type. c) List number and type of all accounts operated in the branch having ID B010. d) List number and name of account holders having savings account in Mumbai. e) Calculate Average balance of accounts present in AX International Bank in New Delhi.	*CO1*	*PO1*	**10**
			UNIT - III			
	5	a)	State the informal guidelines for good relation schema design.	*CO1*	*PO1*	**05**
		b)	Define *fourth normal form*. When is it violated? Justify your answer with example.	*CO2*	*PO2*	**05**
		c)	Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set FD = { PQ → R, P → ST, Q → U, U → VW, and S → XY}, a. Identify the candidate key(s) for R. b. Identify the highest normal form that R satisfies (1NF, 2NF, 3NF). c. If R is not in 3NF, decompose it into a set of 3NF relations that preserve the dependencies.	*CO3*	*PO3*	**10**

			OR			
	6	a)	Given a relation R(P, Q, R, S, T) and Functional Dependency set FD = { QR → PST, S → Q }, a) Identify the candidate key(s) for R. b) Identify the highest normal form that R satisfies (1NF, 2NF, 3NF,BCNF). c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies	*CO3*	*PO3*	**10**
		b)	Explain lossless-join decomposition. Define fifth normal form. Suppose that we decompose the schema R = (A, B, C, D, E) into (A, B, C) (A, D, E) Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds: A → BC CD → E B → D E → A	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Consider the following transactions T1 and T2 operating on a bank database. Initial values: A=500, B=300 **T1** / **T2** R(A) / / R(A) A = A - 100 / W(A) / / A= A * 1.1 / W(A) R(B) / B = B + 100 / W(B) / Verify whether the database remains consistent after executing T1 and T2 concurrently. Provide calculations to justify your answer.	*CO2*	*PO2*	**04**
		b)	With neat State transition diagram illustrate the states for transaction execution.	*CO1*	*PO1*	**07**
		c)	For each of the following schedules, state whether they are serializable and whether they are conflict-serializable. For each schedule, draw the corresponding precedence graph. If the schedule is conflict-serializable, show all the conflict-equivalent serial schedules. a) S1 = r1(A) r2(A) w1(A) w2(A) b) S2 = r1(A) r2(B) w3(A) r2(A) r1(B) c) S3 = r1(A) w2(A) w1(A) r3(A).	*CO2*	*PO2*	**09**
			OR			
	8	a)	Consider the schedules S1, S2, and S3 provided below. Analyze and determine whether each schedule is Strict, Cascadeless, Recoverable, or Non-Recoverable. Justify your classification with detailed reasoning for each property. **S1**: r1(X); w2(Y); r3(X); w1(Z); c1; w2(Z); r3(Y); c2; w3(Z); r2(X); c3; **S2**: r1(X); r2(Y); w1(X); w2(Y); r3(X); r3(Y); w3(Z); c1; r2(Z); w2(X); c2; c3; **S3**: r1(X); r2(Z); w1(X); r3(Y); r2(Y); w3(X); c3; w1(Y); c1; r2(X); w2(Z); c2;	*CO2*	*PO2*	**10**

		b)	Explain Consider the following transactions and their operations. Determine whether the schedule follows the **Two-Phase Locking Protocol (2PL)**. Justify your answer. If it does not follow 2PL, identify the operation that causes the violation.
			Schedule
			Transaction T1:
			lock-X(A); read(A); write(A); lock-X(B); write(B); unlock(A); unlock(B);
			Transaction T2:
			lock-X(B); read(B); write(B); unlock(B); lock-X(A); read(A); write(A); unlock(A);
				CO2	*PO2*	**10**

			UNIT - V			
	9	a)	Discuss the following RAID levels in terms of mechanism, advantages and disadvantages with neat diagram. • RAID 0 • RAID 1 • RAID 5	*CO1*	*PO1*	**10**
		b)	Analyze the impact of various disk performance measures on the overall efficiency of disk-based storage systems.	*CO2*	*PO2*	**10**
			OR			
	10	a)	Explain any three types of indexing in databases. Provide examples for each type and discuss their advantages, and disadvantages.	*CO2*	*PO2*	**10**
		b)	Construct a B+-Tree for the keys 1, 3, 5, 7, 9, 2, 4, 6, 8, and 10, with each node holding a maximum of 3 keys and 4 pointers, demonstrating the step-by-step insertion process and resulting tree structure.	*CO3*	*PO3*	**10**

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