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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Artificial Intelligence & Machine Learning **Duration: 3 hrs.**

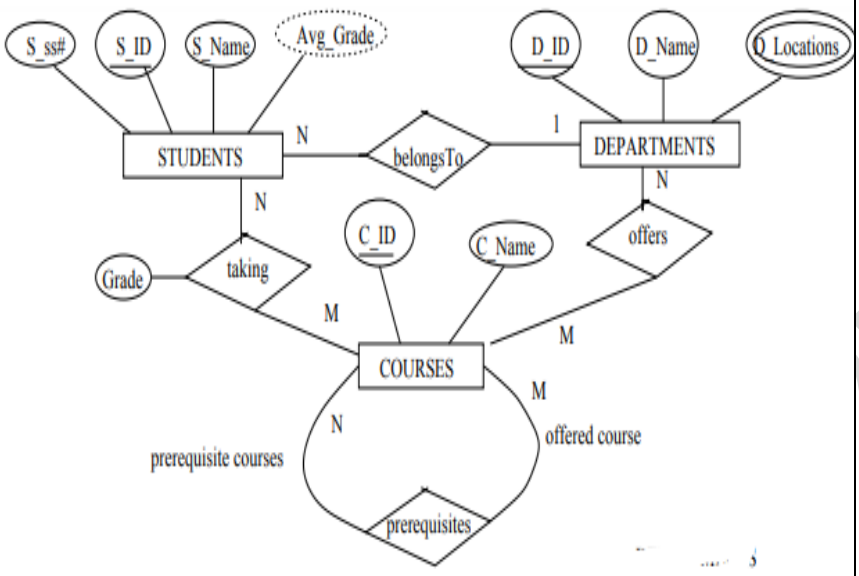
Course Code: 23AM3PCDBM **Max Marks: 100**

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.

				CO	*PO*	Marks
			UNIT - I			
1	a)		Explain the main characteristics of a database approach compared to traditional file systems.	CO1	PO1	**06**
	b)		Illustrate the importance of data independence in a database. Differentiate between logical and physical data independence.	CO2	PO2	**08**
	c)		Explain the roles of DDL, DML, and DCL in a database management system.	CO1	PO1	**06**
			OR			
2	a)		Illustrate the primary components of a DBMS environment	CO1	PO1	**05**
	b)		Differentiate between Two-tier and Three-tier architectures in Client/Server systems	CO1	PO1	**05**
	c)		Explore the interplay among users, compilers, and optimization processes in the context of a database environment. How the compilers and optimization contribute collaboratively to streamline database operations?	CO2	PO2	**10**
			UNIT - II			
3	a)		Model the ER diagram by identifying the entities, keys and the cardinalities of all relationships (e.g., 1:1, N:1, N:M) for the given application: A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by Bookid.	CO3	PO3	**08**

		b)	Give a relational schema diagram for the following ER diagram. Convert the given ER diagram into relational schema using conversion steps. Also, appropriately label the foreign key references with the corresponding foreign keys.  	CO3	PO3	**07**
		c)	Specify the various categories of Relational model database constraints	CO1	PO1	**05**
			OR			
	4	a)	Elaborate the various categories of constraints with suitable example for each	CO2	PO2	**10**
		b)	i. Design an ER diagram with strong and weak entities, attributes, relationship constraints and participation types for the given database application. ii. The university keeps track of each student's name, student number, social security number, current address and phone, permanent address and phone, birthdate, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and zip of the student's permanent address, and to the student's last name. Both social security number and student number have unique values for each student. iii. Each department is described by a name, department code, office number, office phone, and college. Both name and code have unique values for each department. iv. Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of course number is unique for each course. v. Each section has an instructor, semester, year, course, and section number. The section number distinguishes different sections of the same course that are taught during the same semester/year; its values are 1, 2, 3 up to the number of sections taught during each semester. vi. A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3,4 for F, D, C, B, A, respectively).	CO3	PO3	**10**

			UNIT - III			
	5	a)	Explain the informal guidelines that are used as measures to determine the quality of relation schema design with suitable example for each	CO1	PO1	**05**
		b)	Consider the relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies F = {{A, B} → {C}, {A} → {D, E}, {B} → {F}, {F} → {G, H}, {D} → {I, J}}. Find the key of the relation and decompose R into 2NF and 3NF.	CO3	PO3	**07**
		c)	Illustrate the ACID properties of a transaction concept using bank application.	CO2	PO2	**08**
			OR			
	6	a)	What is the need of normalization in database applications? Briefly explain 1NF,2NF, and 3NF With an example for each.	CO2	PO2	**10**
		b)	Consider a relation with schema R (A, B, C, D) and FDs {AB -> C, C -> D, D -> A}. i. Identify the nontrivial FDs that can be inferred from the given FDs? ii. Identify all candidate keys of R? iii. Indicate all BCNF violations for R. iv. Decompose the relations into collections of relations that are in BCNF.	CO2	PO2	**10**
			UNIT - IV			
	7	a)	Explain the B+ tree Index with a suitable example.	CO1	PO1	**05**
		b)	i. How does indexing with hash functions optimize data retrieval and storage in databases? ii. Discuss the advantages and disadvantages of using hash indexing compared to other indexing methods.	CO2	PO2	**07**
		c)	A startup company has four drives and wants to set up a RAID configuration that provides the most storage space while offering basic redundancy. Which RAID level would be the most suitable for their needs?	CO3	PO2	**08**
			OR			
	8	a)	Distinguish between the operational mechanisms of dynamic hashing and static hashing with a neat diagram.	CO2	PO2	**06**
		b)	Demonstrate the Physical disk structure with a pictorial representation.	CO1	PO2	**06**
		c)	How does sequential indexing improve database search performance, and explain its drawbacks when compared to B+ Trees?	CO2	PO2	**08**
			UNIT - V			
	9	a)	Illustrate MongoDB queries to insert a document, retrieve specific data, and update a field within a collection.	CO1	PO1	**06**

		b)	List and describe at least five common data types supported by MongoDB.	CO1	PO1	**06**
		c)	Demonstrate the CAP theorem in the context of distributed systems. How does it guide the design of NoSQL databases?	CO2	PO2	**08**
			OR			
	10	a)	List and explain different types of Database systems supported by NoSQL.	CO1	PO1	**07**
		b)	Discuss the key objects of MongoDB with the help of pictorial representation and suitable examples for each.	CO1	PO1	**05**
		c)	SQL databases follow ACID properties. How do NoSQL databases typically handle consistency, availability, and partition tolerance?	CO2	PO2	**08**

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