cs 4th sem

CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | | BCS403

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Database Management Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define DBMS. Discuss the main characteristics of the database approach and how does it differ from traditional file system.	10	L2	CO1
	b.	Discuss the different types of user-friendly interfaces and the types of users who typically use each.	10	L2	CO1
		OR			
Q.2	a.	Explain three-schema architecture. Why do we need mappings between schema levels?	10	L2	CO1
	b.	Construct an ER diagram for BANK database schema with atleast five entity types. Also specify primary key and structural constructs.	10	L3	CO1
		Module – 2			
Q.3	a.	Explain the characteristics of relations with an example for each.	8	L2	CO1
	b.	Explain entity integrity constraint and referential integrity constraint with an example for each.	8	L2	CO1
	c.	Explain the following unary operations with syntax and example: i) SELECT ii) PROJECT	4	L2	CO1
		OR			
Q.4	a.	Explain ER to relational mapping algorithm with suitable example for each step.	10	L2	CO1
	b.	Consider the following schema: EMP (Fname, Lname, ssn, Dno, Salary) DEPT (Dname, Dnum, Mgr_ssn) D_LOC (Dno, LOC) PROJECT (Pname, Pno, Dno, PLOC) WORKS_ON (Essn, Pno, Hours) Construct the query in relational algebra for the following: i) Display the ssn, firstname and last name of the employee working for department no 5. ii) Retrieve the location of the 'Accounts' department. iii) Select the tuples for all employees who either work in department 4 and make over \$25000 per year , or work in department 5 and make over \$30000. iv) Retrieve the names of the project controlled by department no 5. v) Retrieve the names of employees working on project no 8.	5	L3	CO1

c. Consider the two tables T_1 and T_2 — 5 | L3 | CO1

T1

P	Q	R
10	a	5
15	b	8
25	a	6

T2

A	B	C
10	b	6
25	c	3
10	b	5

Identify the results of the following operations:

i) $\sigma_{Q=a}(T_1)$

ii) $\pi_{A,C}(T_2)$

iii) $T_1 \bowtie_{T_1.P=T_2.A} T_2$

iv) $T_1 \bowtie_{T_1.Q=T_2.B} T_2$

v) $T_1 \cup T_2$.

Module – 3

Q.5 a. Make use of the relation schema in Fig.Q.5(a) to illustrate insertion, deletion and modification anomalies. — 8 | L3 | CO4

EMP_DEPT

Ename	ssn	Bdate	Address	Dname	Dno	Mgr ssn

Fig.Q.5(a)

b. Consider the relation schema LOTS which describes parcels of land for sale in various counties of a state. Suppose that there two candidate keys: Property Id and {County_name, Lot}; that is lot numbers are unique only within each county, but property_Id numbers are unique across counties for the entire state. — 7 | L3 | CO4

LOTS (Property_Id, county_name, Lot, Area, Price, Tax_rate}

The following FDs hold

i) FD1 : Property_Id → (County_name, Lot, Area, Price, Tax_rate}

ii) FD2 : {County_name, Lot} → {Property_Id, Area, Price, Tax_rate}

iii) FD3 : County_name → Tax_rate

iv) FD4 : Area → Price

Construct a relational schema for this database application that are each in 3NF.

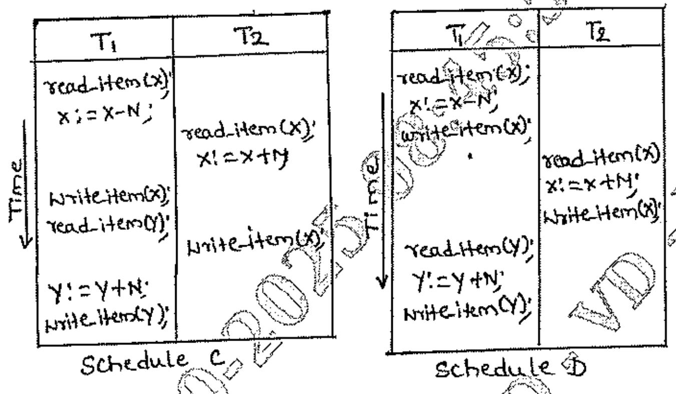
c. For the given relation R(A, B, C, D, E) and its instance (Fig.Q.5(c)), check whether the FDs given hold or not. Give reasons i) $A \to B$ ii) $B \to C$ iii) $D \to E$ iv) $CD \to E$ v) $AB \to E$ — 5 | L3 | CO4

R

A	B	C	D	E
a_1	b_1	c_1	d_1	e_1
a_1	b_2	c_1	d_1	e_1
a_2	b_2	c_1	d_2	e_3
a_2	b_3	c_3	d_2	e_2

Fig.Q.5(c)

		OR			
Q.6	**a.**	Illustrate the structure of SQL retrieval query with syntax and example.	**8**	**L2**	**CO3**
	b.	Consider the following schema: Student (Usn, Name, Age, Branch) Course (Coursecode, Coursename, Credits) Enroll (Usn, Coursecode) Grade (Usn, Coursecode, Grade) Construct the SQL statements to perform the following operations: i) Creating the tables by specifying the primary key and foreign key constraints. ii) Insert a new student <'24CS001', 'Amith', 19, 'CSE'> iii) Change the credit of the course having coursecode 22CS402 from 2 to 3. iv) Delete a student record from the grade table having USN '22CS010'.	**7**	**L3**	**CO3**
	c.	Illustrate the following SQL commands with syntax and example for each : i) CREATE ii) INSERT iii) DELETE iv) UPDATE v) ALTER	**5**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Illustrate creation of triggers and assertions with syntax and example for each.	**10**	**L2**	**CO3**
	b.	Consider the following schema for a COMPANY database Employee (Fname, Lname, ssn, Address, Superssn, salary Dno) Department (Dname, Dnumber, Mgr_ssn, Mgr_stdt) Departmnent_Locs (Dnumber, Dlocation) Project (Pname, Pnumber, Plocation, Dnum) Works_On (Essn, Pno, Hrs) Dependent (Essn, Dependent_name, Sex, Bdate, Relationship) Construct the SQL query for the following: i) List the names of managers who have atleast one dependent. . ii) Retrieve the list of employees and the projects they are working on, ordered by department and within each department, ordered alphabetically by lastname, firstname. iii) For each project, retrieve the project number, the project name and the number of employees who work on that project. iv) For each project on which more than two employees work, retrieve the project number, the project name, and the number of employees who work on the project. v) For each project, retrieve the project number, the project name, and the numbers of employees from department 4 who work on the project.	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Discuss ACID properties. With a neat diagram explain the different states a transaction goes through during its execution.	**10**	**L2**	**CO1**

	b.	Write an algorithm to test conflict serializability of a schedule S. Apply the same to test the serializability of the schedule C and D. 	10	L3	CO1
		Module – 5			
Q.9	**a.**	Illustrate with an algorithm, the shared/exclusive locks.	10	L2	CO1
	b.	Discuss the problems that can occur when concurrent transactions are executed.	10	L2	CO1
		OR			
Q.10	**a.**	Explain the characteristics of NOSQL systems.	10	L2	CO6
	b.	Illustrate MongoDB CRUD operations with an example for each.	10	L2	CO6

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BCS405A

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025

Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Define Tautology and Contradiction. Show that for any proposition p and q the compound proposition $[p \rightarrow (p \vee q)]$ is a tautology and the compound proposition $[p \wedge (\sim p \wedge q)]$ is a contradiction by using truth table.	**06**	**L2**	**CO1**
	b.	Prove the following logical equivalence without using truth table: i) $[(p \rightarrow q) \wedge \{\sim q \wedge (r \vee \sim q)\}] \Leftrightarrow \sim(q \vee p)$ ii) $\{[\sim p \wedge (\sim q \wedge r)] \vee (q \wedge r) \vee (p \wedge r)\} \Leftrightarrow r$	**07**	**L2**	**CO1**
	c.	Prove the following is a valid argument : $p \rightarrow (q \wedge r)$ $r \rightarrow s$ $\sim(q \wedge s)$ $\therefore \sim p$	**07**	**L3**	**CO1**
		OR			
Q.2	**a.**	For inverse of all real numbers, let p(x): $x \geq 0$, q(x) : $x^2 \geq 0$, r(x) : $x^2 - 3x - 4 = 0$ s(x) : $x^2 - 3 > 0$. Determine the truth values of the following : (i) $\exists x, p(x) \wedge q(x)$ (ii) $\forall x, p(x) \rightarrow q(x)$ (iii) $\forall x, q(x) \rightarrow s(x)$ (iv) $\forall x, r(x) \vee s(x)$	**06**	**L2**	**CO1**
	b.	Test the validity of the following arguments: If a triangle has two equal sides, then it is isosceles If a triangle is isosceles, then it has two equal angles The triangle ABC does not have two equal angles ∴ ABC does not have two equal sides	**07**	**L3**	**CO1**
	c.	Give indirect proof for the following statement: (i) For all integers k and l, if kl is odd, then both k and l are odd. (ii) For all integers k and l, if k + l is even, then k and l are both even or both odd.	**07**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Prove by Mathematical induction, for all integers $n \geq 1$ $1.2 + 2.3 + 3.4 + \ldots\ldots + n(n+1) = \frac{1}{3}n(n+1)(n+2)$	**06**	**L2**	**CO2**
	b.	A sequence $\{a_n\}$ is defined recursively by $a_0 = 1$ $a_1 = 1$ $a_2 = 1$ and $a_n = a_{n-1} + a_{n-3}$ for all $n \geq 3$. Prove that $a_{n+2} \geq (\sqrt{2})^n$ for all integer $n \geq 0$.	**07**	**L2**	**CO2**

Q.3	c.	Find the number of permutations of the letters of word MASSASAUGA. In how many of these, all four A's are together? How many of them begin with S?	07	L3	CO2
		OR			
Q.4	a.	From seven consonants and five vowels, how many sets consisting of four different consonants and three different vowels can be formed?	06	L2	CO2
	b.	Find the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$	07	L3	CO2
	c.	In how many ways can 10 identical pencils be distributed among 5 children in the following case: (i) There are no restrictions (ii) Each child gets atleast one pencil (iii) The youngest child gets atleast two pencils	07	L3	CO2
		Module – 3			
Q.5	a.	Let A = {1, 2, 3, 4} and B = {1, 2, 3, 4, 5, 6} (i) Find how many functions are there from A to B. How many of these are one to one? (ii) Find how many functions are there from B to A. How many of these are onto? How many are one to one?	06	L2	CO3
	b.	State Pigeonhole Principle. How many persons must be chosen in order that at least five of them will have birthdays in the same calendar month?	07	L3	CO3
	c.	Prove that "A function $f : A \to B$ is invertible if and only if it is one to one and onto".	07	L2	CO3
		OR			
Q.6	a.	Let A = {1, 2, 3, 4} and R be the relation on A defined by xRy if and only if "x divides y", written as x/y. (i) Write down R as a set of ordered pairs. (ii) Draw the digraph of R, matrix M(R) (iii) Determine the indegree and outdegree of the vertices in the digraph.	06	L2	CO3
	b.	Let A = {1, 2, 3, 4, 5}. Define a relation R on A × A by $(x_1, y_1)\ R\ (x_2, y_2)$ if and only if $x_1 + y_1 = x_2 + y_2$. (i) Verify that R is an equivalence relation on A×A (ii) Determine the equivalence classes of [(1, 3)] (iii) Determine the partition of A×A induced by R	07	L3	CO3
	c.	Let s = {1, 2, 3} and P(S) be the power set of S. On P(S) define the relation R by XRY if and only of $X \le Y$. Show that this relation is a partial order on P(S). Draw its Hasse diagram.	07	L2	CO3

		Module – 4			
Q.7	**a.**	Define Derangement. Find the number of derangements of 1, 2, 3, 4. List them.	**06**	**L2**	**CO4**
	b.	Find the number of permutations of the letters a, b, c, ….x, y, z in which none of the patterns spin, game, path or net occurs.	**07**	**L3**	**CO4**
	c.	Four persons P_1, P_2, P_3, P_4 who arrive late for a dinner party find that only one chair at each of five tables T_1, T_2, T_3, T_4 and T_5 is vacant. P_1 will not sit at T_1 or T_2, P_2 will not sit at T_2, P_3 will not sit at T_3 or T_4 and P_4 will not sit at T_4 or T_5. Find the number of ways they can occupy the vacant chairs.	**07**	**L3**	**CO4**
		OR			
Q.8	**a.**	Out of 30 students in a hostel, 15 study History, 8 study Economics and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects.	**06**	**L3**	**CO4**
	b.	Solve the recurrence relation $a_n - 3a_{n-1} = 5 \times 3^n$ for $n \geq 1$ given that $a_0 = 2$.	**07**	**L2**	**CO4**
	c.	Determine the number of positive integers n such that $1 \leq n \leq 100$ and n is not divisible by 2, 3 or 5.	**07**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	If $*$ is an operation on z defined by $x * y = x + y + 1$, prove that $(z, *)$ is an abelian group.	**06**	**L2**	**CO5**
	b.	The symmetric group S_4 consists of all the permutations of the set $A = \{1, 2, 3, 4\}$. What is the order of S_4? What is the identity element in S_4? If $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 3 & 1 \end{pmatrix}$ and $\beta = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 2 & 1 & 3 \end{pmatrix}$ Verify the $(\alpha\,\beta)^{-1} = \beta^{-1}\,\alpha^{-1}$	**07**	**L3**	**CO5**
	c.	Let G be a group and let $J = \{x \in G \,/\, xy = yx \text{ for all } y \in G\}$ Prove that J is a subgroup of G.	**07**	**L2**	**CO5**
		OR			
Q.10	**a.**	Prove that the group $(z_4, +)$ is cyclic. Find all its generators.	**06**	**L3**	**CO5**
	b.	Prove the theorem "There exists a one to one correspondence between the elements of a subgroup and the elements of the left (right) coset thereof".	**07**	**L2**	**CO5**
	c.	State and prove Lagrange's theorem.	**07**	**L2**	**CO5**

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