

Roll No: \_\_\_\_\_

MCA  
(SEM I) THEORY EXAMINATION 2025-26  
DISCRETE MATHEMATICS

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief. 02 x 7 = 14

Q no.	Question	CO	Level
a.	Is function $f: R \rightarrow R$ , defined as $f(x) =  x  + x$ , one to one? Reason?	1	K3
b.	Define Multiset with an example.	1	K2
c.	Define Lattice and Complete lattice.	2	K1
d.	Use quantifiers to express the statement "All students in the class have taken a course in Discrete Mathematics" and also write its negation.	3	K2
e.	State the Lagrange's theorem with reference to Group theory.	4	K1
f.	Test whether the permutation $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 4 & 3 & 5 & 2 & 6 \end{pmatrix}$ is even permutation or odd permutation?	4	K3
g.	Use Pigeonhole principle to find the minimum number of students in a class to be sure that four out of them are born in the same month.	5	K3

SECTION B

2. Attempt any three of the following: 07 x 3 = 21

a.	Let $R$ be a relation in a set of integers $Z$ defined by $R = \{(x, y) : x - y \text{ is divisible by } 6, x, y \in Z\}$ . Justify that $R$ is an equivalence relation or partially ordered relation in $Z$ .	1	K3
b.	Convert the Boolean expression $[(xy' + xz)' + x']$ into Disjunctive normal form and Conjunctive normal form.	2	K2
c.	Check the validity of the following argument: If 2 is an odd number then 4 does not divide 10. Either 11 is not a prime number or 4 divides 10. But 11 is a prime number, therefore 2 is an even number.	3	K3
d.	Prove that the set of all positive rational numbers forms an abelian group under the operation $*$ , defined as $a * b = \frac{a+b}{2}$ .	4	K4
e.	Solve the following Recurrence relation: $a_r - 7a_{r-1} + 10a_{r-2} = r + 2$ given $a_0 = 2, a_1 = 1$	5	K3

SECTION C

3. Attempt any one part of the following: 07 x 1 = 07

a.	(i) Is function $f: R \rightarrow R$ , given by $f(x) = \cos x$ , bijective? Justify. (ii) Let a function $f: R \rightarrow R$ , given by $f(x) = x^2$ then find $f^{-1}(16)$ and $f^{-1}(-16)$ .	1	K3
b.	If $A, B, C$ are three sets then show that $(A - B) \times C = (A \times C) - (B \times C)$	1	K2

4. Attempt any one part of the following: 07 x 1 = 07

a.	Let $A = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$ be any set. The relation $\leq$ in set $A$ is defined as $x \leq y$ when $x$ divides $y$ . Is the set $(A, \leq)$ partially ordered set (poset)? If yes, draw the Hasse	2	K3
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	diagram for this poset and hence list all the maximal, minimal, greatest and least elements of the poset .		
b.	Draw a logic gate circuit for the following Boolean expression: [a + (b + c). a']. b' + c. [b. (a + c') + a. (b' + c)] Also draw a circuit for the minimized form of above Boolean expression.	2	K3

5. Attempt any one part of the following: 07 x 1 = 07

a.	Test whether the statement $p \Rightarrow (\sim q \vee r)$ is a tautology or a contradiction or a contingency. Also, test whether $p \Rightarrow (\sim q \vee r) \equiv (p \Rightarrow \sim q) \vee (p \Rightarrow r)$ .	3	K3
b.	Define quantifiers and its types with suitable examples. Translate each of the following statements into symbols using quantifiers, variables and predicate symbols: (i) There is a student who can speak Tamil and who knows C++ (ii) There is a student who can speak Tamil but does not know C++ (iii) Every student either can speak Tamil or knows C++ (iv) No student can speak Tamil or knows C++	3	K2

6. Attempt any one part of the following: 07 x 1 = 07

a.	If $R$ be a group of real numbers under addition and let $I^+$ be the group of positive real numbers under multiplication. Let $f: R \rightarrow R^+$ be defined as $f(x) = e^x$ then show that $f$ is an isomorphism.	4	K3
b.	Prove that the set $R = \{a + b\sqrt{5} : a, b \text{ are integers}\}$ is a commutative ring with unity with respect to usual addition and multiplication.	4	K3

7. Attempt any one part of the following: 07 x 1 = 07

a.	Show that $n^2 > (2n + 1)$ for $n \geq 3$ by Mathematical Induction.	5	K3
b.	Find Generating functions of the following numeric functions (i) $a_n = n \cdot 3^n, n \geq 0$ (ii) $b_n = \frac{(-1)^n(n+2)(n+1)}{2}, n \geq 0$	5	K3

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