PAPER ID-310164

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 $f: R \to R$, 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 $R = \{(x, y): x - y \text{ is divisible by } 6, x \in Z, y \in Z\}$. 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 Q^+ forms an abelian group under the operation $' * '$, defined as $a * b = \dfrac{ab}{2}$.	4	K4
e.	Solve the following Recurrence relation: $a_r - 7a_{r-1} + 10a_{r-2} = r + 2$ given $a_0 = 1, a_1 = 1$	5	K3

SECTION C

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

a.	(i) is function $f: R \to R$, given by $f(x) = \cos x$, bijective? Justify. (ii) Let a function $: R \to R$, 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 $(A - B) X C = (A X C) - (B X C)$	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 $' \preccurlyeq '$ in set A is defined as $x \preccurlyeq y$ when x divides y. Is the set $(A, \preccurlyeq)$ 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 $p \Rightarrow (\sim q \lor r)$ is a tautology or a contradiction or a contingency. Also, test whether $p \Rightarrow (\sim q \lor r) \equiv (p \Rightarrow \sim q) \lor (p \Rightarrow r)$.	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 R^+ be the group of positive real numbers under multiplication. Let $f: R \to R^+$ be defined as $f(x) = e^x$ then show that f is an isomorphism.	4	K3
b.	Prove that the set $R = \{a + b\sqrt{5} : a, b$ 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 $(i) a_n = n.3^n$, $n \geq 0$ $(ii) b_n = \frac{(-1)^n(n+2)(n+1)}{2}$, $n \geq 0$	5	K3