

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

MCA (Sem.-1)

DISCRETE STRUCTURES & OPTIMIZATION

Subject Code : PGCA-1917

M.Code : 79035

Date of Examination : 07-01-2025

Time : 3 Hrs.

Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying TEN marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Write short notes on :

- Find generating function for series $-3, 9, -27, \dots$
- Give an example of relation which is neither reflexive, nor symmetric, nor transitive, nor anti-symmetric.
- A graph has 21 edges, 3 vertices of degree 4 and other vertices are of degree 3. Find the number of vertices of graph G.
- Find g of Where $f(x) = 2x + 1$ and $g(x) = x^2 - 2$.
- Give an example of a relation which is neither reflexive. Prove that $F(x) = 3x + 5$ for all $x \in \mathbb{R}$ is invertible, where $f: \mathbb{R} \rightarrow \mathbb{R}$.
- Write Dual of each Boolean Equation : (i) $(a \times 1) \times (0 + a') = 0$ (ii) $a + a'b = a + b$.
- Find the greatest lower bound and upper bound of the sets $\{3, 9, 12\}$ and $\{1, 2, 4, 5, 10\}$, if they exist in a POSET $(\mathbb{Z}^+, |)$.
- Define fields with example.
- Define B-trees.
- What do you mean by commutative ring?

SECTION-B

2. a) Let R be relation on the set of ordered pair of positive integers such that $(x, y) R (u, v)$ if $xv = yu$. Show that R is an equivalence relation.
b) Draw Hasse diagram representing the partial ordering $\{(a, b) \mid a \text{ divides } b\}$ on $\{1, 2, 3, 4, 6, 12, 24, 48, 72\}$.
3. a) How many bit strings of length seven either begin with two 0s or end with three 1s?
b) How many poker hands of five cards can be dealt from a standard deck of 52 cards? Also, how many ways are there to select 47 cards from a standard deck of 52 cards?
4. a) Define an ideal of a ring. Discuss ring homomorphisms and the connection with ideals.
b) Use K-maps to minimize the sum of products expansion $xyz + x\bar{y}\bar{z} + \bar{x}yz + \bar{x}\bar{y}\bar{z}$.
5. Solve Recurrence Relation $a_n = 5a_{n-1} - 6a_{n-2} + 2^n + 3$.

SECTION-C

6. a) State and prove Euler's formula.
b) Show that an undirected graph has an even number of vertices of odd degree.
7. a) State and prove Lagrange's theorem.
b) Define cut points and spanning tree along with examples.
8. Prove that $(\mathbb{Z}, *)$ is an abelian group.
9. a) Describe three different methods that can be used to represent a graph.
b) Draw a simple, graph with at least five vertices and eight edges. Illustrate how it can be represented using the methods that are described in part (a).

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.