Roll No. [ ] **Total No. of Pages : 02**

Total No. of Questions : 09

MCA (Sem–1)

DISCRETE STRUCTURES AND OPTIMIZATION

Subject Code : PGCA-1917

M.Code : 79035

Date of Examination : 25-05-2023

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 briefly :

   a) If f, g : R→ R be defined by $f(x) = x^2+2x+2$, $g(x) = 2x-3$. Find fog, gog.

   b) Find generating function for series -5, 25,-125………

   c) Define B-Tree.

   d) Consider following relation on set A={1,2,3}, S =Empty relation, T = Universal Relation. Determine whether or not each of above relation on A is an equivalence relation.

   e) Differentiate between POSET and equivalence relation.

   f) Prove that maximum number of edges in a simple graph having n vertices is n(n-l)/2.

   g) How many permutations of the letter ABCDEFGH contains the string ABC?

   h) How many edges are there in a tree having n vertices.

   i) Define kernel of a Homomorphism.

   j) Give an example of a relation which is both symmetric and anti symmetric.

SECTION-B

2. a) Let R be relation on the set of ordered pair of positive integers such that (a,b), (c,d) ε R if and only if a+d=b+c. Show that R is an equivalence relation.

   b) Draw Hasse diagram for divisibility on D_{30}.

3. a) How many bit strings of length ten contains either three consecutive 0s or four c onsecutive 1s?

   b) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades A, B, C, D and F.

4. a) Construct circuits from NOT, AND gates and OR gates to produce these outputs.

   i) x y z + x' y' z'

   ii) ((x'+z) (y+z'))'

   b) Let (A, +, .)be a ring such that a . a= a for all a in A. Show that a + a= 0 for all a, where 0 is the additive identity. Also show that operation is commutative.

5. Solve recurrence relation $a_n=4a_{n-1}\ 4a_{n-2} + (n+l)+2^n$.

SECTION-C

6. Show that $< Z, + >$ is a group.

7. a) State and prove Lagrange's theorem.

   b) Prove that equality relation is a congruence relation on any algebra

8. a) State and prove Euler's theorem.

   b) Show that every connected graph with n vertices has at least n- 1 edges.

9. a) Draw all subgraphs of the graph with edges (d,a), (d,c) and (d,b).

   b) Determine whether the graph with the edges (a,b), (a,e), (b,c), (b,d), (b,e), (c,d), (d,e) has a Hamilton circuit.

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.