

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 : 03-01-2026

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 at least TWO questions from SECTION - B & C.**

SECTION - A

- I. Write short notes on :**
- Explain the concept of a compatibility relation and its importance.
 - What are the key properties of a hash function?
 - Given a set $A = \{1, 2, 3, 4, 5\}$, how many different equivalence relations can be defined on set A ?
 - What is the chromatic number of a graph?
 - What is a Euclidean domain? Give an example.
 - Explain what a subgroup is in the context of group theory.
 - Define a congruence relation on a semigroup.
 - What is the key difference between directed and undirected graphs?
 - Define an Eulerian path and an Eulerian cycle.
 - Define a plane graph and a connected graph.

SECTION - B

2. Describe the applications of Boolean algebra in logic implications, logic gates, and Karnaugh maps.
3.
 - a. Explain the concept of Euclidean domains and provide examples.
 - b. Discuss integral domains and their relationship with fields.
4. Discuss the operations that can be performed on relations and their properties.
5.
 - a. Explain the concept of permutations and how they are calculated.
 - b. Describe generating functions and their role in counting problems.

SECTION - C

6. Discuss the importance of congruence relations in semigroups and explain how they are used to classify elements within a semigroup.
7. Compare and contrast a semigroup, monoid and group, highlighting their similarities and differences.
8. Explain the concept of Hamiltonian paths and cycles and discuss their relationship to the travelling salesman problem.
9. Explain the concepts of graph isomorphism and graph homomorphism and discuss their applications in graph theory.

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.