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[Roll No.

MCS-501

MCA/MSCIT Ist/IIIrd Semester Examination Dec., 2023

DISCRETE MATHEMATICS

Time : 2 Hours]

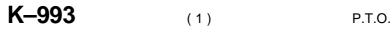
[Max. Marks: 70

Note :- This paper is of Seventy (70) marks divided into two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given there in. *Candidates should limit* their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section-A

(Long Answer Type Questions) 2×19=38

Note :- Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.



- 1. (a) Define an equivalence relation with the help of suitable example. (10)
 - (b) Define the following terms with the help of suitable examples : (9)
 - (i) One-One Onto function
 - (ii) Recursively defined function
- 2. (a) Define the following terms with the help of suitable examples : (10)
 - (i) Tautology
 - (ii) Contradiction
 - (iii) Conjunctive normal form
 - (iv) Disjunctive normal form
 - (b) Check the validity of the following argument."If I play, then I dance. I do not dance. Therefore, I do not play". (9)
- 3. (a) Explain direct method of proof. Using direct method, prove that the square of an even number is an even number. (10)
 - (b) Solve the recurrence relation : (9)

$$a_n + 4a_{n-1} + 3a_{n-2} = 4n + 3$$

4. (a) Define generating function. Find the numeric function corresponding to the generating function

(2)

$$\mathbf{G}(x) = \frac{x}{1 - 2x}.$$
(10)

(b) Show that the set of all positive rational numbers forms an abelian group under the composition a^*b

$$=\frac{ab}{2}$$
 (9)

- 5. (a) Define the following graphs with the help of suitable examples :
 - (i) Complete graph
 - (ii) Regular graph
 - (iii) Bipartite graph
 - (iv) Euler graph (10)
 - (b) Discuss Chomsky hierarchy. (9)

Section-B

(Short Answer Type Questions) 4×8=32

- *Note* :- Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.
- 1. Let X = (2, 3, 4) and $R = [(x, y) : x \le \forall x, y \in X]$ be a relation on X. Find the matrix and draw the graph of the relation R.
- 2. Draw the Venn diagram of the following sets :
 - (i) $(X \cup Y) \cap Z$
 - (ii) $X \cap (Y \cup Z)'$
 - (iii) $(X \cup Y) Z'$
 - (iv) $X' \cap (Y \cup Z)$
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(3)

P.T.O.

- 3. Define deterministic finite automaton. Let $\Sigma = \{a, b\}$ then design a DFA that accepts all the strings that starts with ab and terminates in *ba*.
- 4. Write predicates for the following sentences :
 - (i) All boys are tall.
 - (ii) Some of the animals are not black.
- 5. Define Tree, Rooted Tree and Binary Tree with the help of suitable examples.
- 6. Define Moore machine. Design a Moore machine that generates the complement of a binary number.
- 7. Define a subgroup. Prove that the union of two subgroups is a subgroup if one of them is contained in the other.
- 8. Prove that the set of integers forms a ring with respect to usual addition and multiplication.

(4)