Roll No. ....

OLE-24041

B. Tech. 3rd Sem. (CS & IT) Examination – April, 2021

DISCRETE STRUCTURE

Paper : CSE-203-F

Time : Three Hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) Let $X = \{a, b, c\}$. Consider function $f : X \rightarrow X$ such that $f = \{(a, b), (b, a), (c, c)\}$. Determine f^{-1}.

    (b) Consider the following statements :

    >   p : He is coward.

    >   q : He is lazy.

    Write the compound statement "he is neither coward nor lazy" in the symbolic form.

    (c) When is a group (G,*) called abelian ?

(d) Give an example of Hamiltonian graph which is not Euler.

(e) Define a semigroup.

(f) For what values of n does K_n, the complete graph on n nodes have an Euler circuit ?

(g) Write the generating function for the sequence : $1, a, a^2, a^3, ...$.   20

SECTION – A

2. (a) Define the following terms with suitable examples :   12

  (i) Bijective function

  (ii) Partial order relation

  (iii) Lattice

  (b) Define equivalence relation. Suppose that R_1 and R_2 are equivalence relations on set S. Determine whether each of these combinations of R_1 and R_2 must be an equivalence relation :   8

  (i) $R_1 \cap R_2$

  (ii) $R_1 \cup R_2$

  Justify your answer.

3. (a) Classify the following propositions into Tautologies and contradiction :   10

  (i) $(p \leftrightarrow q) \leftrightarrow ((p \wedge q) \vee (\sim p \wedge \sim q))$

  (ii) $p \vee \sim (p \wedge q)$

  (b) State and prove De Morgan's law of algebra of sets.   10

SECTION – B

4. (a) Solve the recurrence relation $a_{r+2} - 5a_{r+1} + 6a_r = r^2$.

   12

   (b) Find the sum of first n terms of the series :   8

   $0.5 + 0.55 + 0.555 + 0.5555 + \ldots\ldots\ldots$

5. (a) How many bit strings contain exactly eight 0's and ten 1's if every 0 must be followed by a 1.   10

   (b) A five person committee having members Ankit, Ravi, Mohan, Amit and Rohit is to select president, vice president and secretary :   10

   (i) In how many ways can this occur if either Ravi or Mohan must be president ?

   (ii) How many ways are there in which either Amit is secretary or he is excluded ?

SECTION – C

6. (a) Differentiate between the following :   12

   (i) Group and Field

   (ii) Homomorphism, Isomorphism and Automorphism

   (b) Consider an algebraic system $(Q, *)$ where Q is set of all rational numbers and $*$ is binary operation defined by –   8

   $a * b = a + b - ab$ *for all a, b* $\in Q$

   Determine whether $(Q, *)$ is a group.

7. (a) Define the following terms with suitable examples :   **10**

    (i) Coset

    (ii) Cyclic group

    (iii) Integral Domain

(b) State and Prove Lagrange's theorem.   **10**

SECTION – D

8. (a) Define the following terms with suitable examples :   **12**

    (i) Spanning Tree

    (ii) Euler graph

    (iii) Planar graph

(b) Prove that number of odd degree vertices in an undirected graph is even.   **8**

9. (a) Find the shortest path between a and z using Dijkstra's algorithm :   **10**
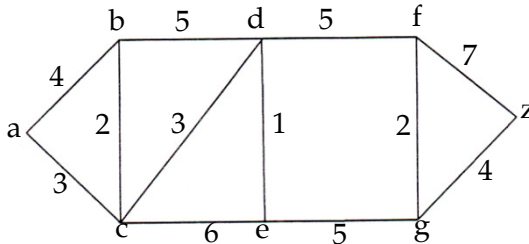
(b) Draw the unique binary tree for the given Inorder and Postorder traversal :   **10**

Inorder :	4	6	10	12	8	2	1	5	7	11	13	9	3
Postorder :	12	10	8	6	4	2	13	11	9	7	5	3	1