

**MCA**  
**(SEM. I) THEORY EXAMINATION 2022-23**  
**DISCRETE MATHEMATICS**

Time: 3 Hours

Total Marks: 100

**Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

- (a) State the Distributive and Associative laws of set theory.
- (b) Write down the properties of Equivalence Relation.
- (c) Define the Hasse diagram with example.
- (d) What do you mean by Normal Form in Boolean algebra?
- (e) Define the term Proposition.
- (f) Negate the statement "He is poor and laborious"
- (g) Define Monoid with example.
- (h) Define the Commutative Ring with unity.
- (i) Solve the recurrence relation:  $a_{3n} - 3a_{2n} + 2a_n = 0$ .
- (j) Write down the properties of Generating function.

**SECTION B****2. Attempt any three of the following: 10x3=30**

- (a) If  $X = \{1, 2, 3\}$ ,  $Y = \{p, q\}$  and  $Z = \{a, b\}$  and the functions  $f$  and  $g$  are define as  
 $f : X \rightarrow Y$  be  $f = \{(1, p), (2, p), (3, q)\}$ ,  
 $g : Y \rightarrow Z$  be  $g = \{(p, q), (q, b)\}$  then find  $f \circ g$  and  $g \circ f$ .
- (b) Let  $L$  be the set of all factor of 12 and let ' $\mid$ ' be the divisibility relation on  $L$ .  
Then show that  $(L, \mid)$  is a lattice.
- (c) Show that:  $(p \leftrightarrow q \wedge q \leftrightarrow r \rightarrow p \leftrightarrow r)$  is a Tautology.
- (d) What do mean by Order of an element in a group?  
Find the order of each element of the multiplicative group  $G = \{1, -1, i, -i\}$ .
- (e) Solve the recurrence  $a_{4n} - 4a_{3n} + 4a_{2n} - 2a_n = 0$

**SECTION C****3. Attempt any one part of the following: 10x1=10**

- (a) Define the function and explain the difference between function and relation with example
- (b) For any set  $A$  and  $B$ , Prove that :  $P(A \cap B) = P(A) \cap P(B)$  .

4. Attempt any *one* part of the following: 10x1=10

- (a) Define Modular Lattice. Also Prove that: Every Distributive lattice is Modular.  
(b) Solve using K-map:  $F(A, B, C, D) = \sum 0,1,2,3,4,5,6,7,8,9,11$

5. Attempt any *one* part of the following: 10x1=10

- (a) Show that  $s$  is a valid conclusion from the premises:  
 $p \rightarrow q, p \rightarrow r, \sim q \wedge r$  and  $\forall p$ .  
(b) If  $Kx : x$  is student,  $Mx : x$  is clever,  $Nx : x$  is successful.  
Express the following using quantifiers:  
(i) There exists a student  
(ii) Some students are clever  
(iii) Some students are not successful.

6. Attempt any *one* part of the following: 10x1=10

- (a) Define the permutation group. If  $A = \{1, 2, 3, 4, 5\}$  then find:  
 $(1\ 3)\ 0\ (2\ 4\ 5)\ 0\ (2\ 3)$ .  
(b) Show that  $G = \{0,1,2,3,4\}$  is a cyclic group under addition modulo 5.

7. Attempt any *one* part of the following: 10x1=10

- (a) Determine the numeric function corresponding to the following Generating function:  
 $AZ = \frac{1}{1-3Z+2Z^2}$   
(b) Prove by mathematical induction that  $n^2 - 2n$  is divisible by 3 for each positive integer  $n$ .