

B.E. / B.Tech. Computer Science & Engineering (Model Curriculum) Semester-IV  
**SE201CS - Discrete Mathematics-III**

P. Pages : 3

Time : Three Hours



**GUG/W/24/13806**

Max. Marks : 80

- Notes : 1. All questions carry equal marks.  
2. Use of non programmable calculator is permitted.

1. a) Prove that 8

i)  $A \cap (B - C) = (A \cup B) - (A \cup C)$

ii)  $(A \cap B) - C = (A - C) \cap (B - C)$

b) Let  $A = \{1, 2, 3\}$ . The relation matrices  $M_R$  &  $M_S$  are given by 8

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}, M_S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Find  $M_R^{-1}$ ,  $M_S^{-1}$ ,  $M_{R \cup S}$ ,  $M_{R \cap S}$

**OR**

2. a) Of a group of 20 person, 10 are interested in music 7 are interested in photography & 4 like swimming. Further more 4 are interested in both music & photography, 3 are interested in both music & swimming, 2 are interested in both photography & swimming & one is interested in music, photography & swimming. How many are interested in photography but not in music & swimming? 8

b) List all possible functions from set  $X = \{a, b\}$  to set  $Y = \{1, 2, 3\}$  indicate in each case whether the function is one one as onto or both. 8

3. a) Prove by truth tables 8

i)  $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

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

b) Determine the validity of the following argument. 8  
If Julia does not live in Italy, then she does not speak Italian. Julia does not drive a car.  
If Julia lives in Italy, then she travels by train. Either Julia speaks Italian or she drives a car. Therefore Julia travels by train.

**OR**

4. a) Write converse, inverse, contrapositive and negation of 'If I move fast, then I may get the grade'. 8
- b) Check for tautology, contradiction & contingency of the following- 8
- i)  $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$
- ii)  $(p \rightarrow (q \wedge r)) \rightarrow (p \rightarrow q)$
5. a) If G is a group of even order. Prove that it has an element  $a \neq e$  satisfying  $a^2 = e$ . 8
- b) Show that the  $\{0, 1, 2, 3, 4\}$  is a finite abelian group of order 5 under addition module 5 as composition. 8

**OR**

6. a) If R is a ring such that  $a^2 = a \forall a \in R$  then prove that 8
- i)  $a + a = 0 \forall a \in R$
- ii)  $a + b = 0 \Rightarrow a = b$
- iii) R is commutative ring
- b) Show that the set  $(0, 1, 2, 3, 4, 5)$  is a communicative ring w.r.t. addition modulo 6 & multiplication modulo 6 as the composition. 8
7. a) Define lattice, draw the Hasse diagram of  $S_{45}$ . Write complement of each element of  $S_{45}$ . Is the lattice  $(S_{45}, D)$  complemented? 8
- b) Construct a switching circuit for the following Boolean expression. Also construct an equivalent simplified circuit & verify equivalence by truth table 8
- $(A + B)(B' + C) + (C' + A) \cdot (C + B)$

**OR**

8. a) Define distributive lattice show that every chain  $(L, \vee, \wedge)$  is distributive lattice. 8
- b) Let  $(B, \wedge, \vee, 0, 1)$  be a Boolean algebra. Define the operator  $+, -$  on the element B by 8
- $a + b = (a \wedge b') \vee (a' \wedge b)$
- $a \cdot b = a \wedge b$  for all  $a, b \in B$
- Show that
- i)  $a + b + b = a$  ii)  $a + b = a$
- iii)  $a + 1 = a$  iv)  $a \cdot (b + c) = a \cdot b + a \cdot c$

9. a) Construct tree diagram corresponding to algebraic expression 8
- i)  $\{(3-(2x))\} + \{(x-2)-(3+x)\} + xy$
- ii)  $(2x + (3-4x)) + (x - (3 \times 11))$

- b) Draw the digraphs corresponding to the adjacency matrix & show that they are isomorphic 8

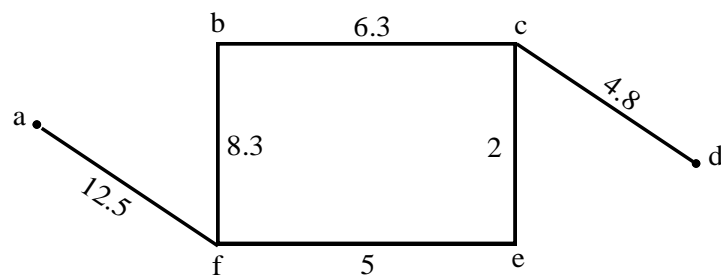
$$A = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \end{bmatrix}$$

**OR**

10. a) Define: 8

- i) Path ii) Reachability
- iii) Node – Base iv) Directed Graph

- b) Using Prim's Algorithm find the minimal spanning tree of the following weighted graph 8



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