B.E. Computer Science & Engineering (Model Curriculum) Semester - IV

SE201CS - Discrete Mathematics-III

P. Pages : 3 **GUG/S/23/13806**

Time : Three Hours * 2 5 4 3 * Max. Marks : 80

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

1. a) Let f be the set of all one-one & onto mapping from x to x, where $x = \{1, 2, 3\}$. Find all elements of f and also find inverse of each elements. **8**

b) Let A = {1, 2, 3} the relation 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) Prove that – **8**
i) $(A - C) \cap (B - C) = (A \cap B) - C$
ii) $A \cap (B - C) - (A \cap B) - (A \cap C)$

b) Let function $f(x) = x - 3$, $g(x) = x + 1$ and $h(x) = 4x$ for $x \in R$ where R is set of real number find gof, fog, fof, fohog, hofof . **8**

3. a) Determine the validity of following argument **8**
"If I study then I will not fail in mathematics.
If I do not play basketball then I will study.
But I failed in mathematics
$\therefore$ Therefore I must have played basketball".

b) Check for tautology contradiction and contingency the following : **8**
i) $[(p \to q) \wedge (q \to r)] \to (p \to r)$
ii) $(p \to (q \wedge r)) \to (p \to q)$

OR

4. a) Negate the statement **4**
i) If it shows then they do not drive.
ii) The car A triangle is isosceles iff two side are equal.

b) Verify that proposition **4**
$(p \vee q) \wedge \sim(p \vee q)$ is a contradiction.

c) Using rules of inference, determine whether the following inference is valid or not **8**

$\sim p \rightarrow \sim q$

$\sim r$

$p \rightarrow s$

$q \vee r$

$\therefore s$

5. a) Show that the set {0, 1, 2, 3, 4, 5} is a commutative ring w, r, to addition modulo 6 and multiplication modulo 6 as the compositions. **8**

b) 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.

OR

6. a) Show that the set A = {1, 2, 3} under multiplication modulo 4 is not a group but B = {1, 2, 3, 4} under multiplication modulo 5 is a group. **8**

b) If G is an abelian group then for all $a, b \in G$ & for all integers n, prove that **8**

$(a \cdot b)^n = a^n \cdot b^n$.

7. a) Draw the Hasse diagram of the lattice D_{30}. Write the complement of each element. **8**

b) Construct switching circuit for Boolean polynomial $(A \cdot B) = \left[A' \cdot (A + B + B')\right]$. Simplify and draw equivalent circuit verify the result by truth table. **8**

OR

8. a) Let S and T be two finite set such that S = {a, b, c} and T = {1, 2, 3} then show that $(P(S), \subseteq)$ and $(P(T), \subseteq)$ are isomorphic. **8**

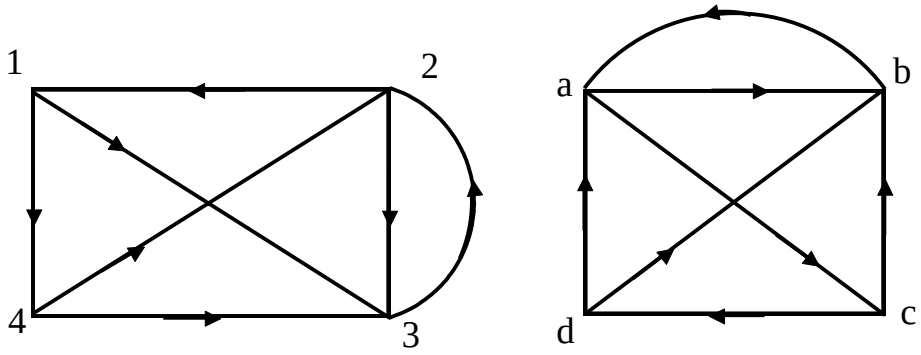
b) In a Boolean Algebra prove that – **8**

i) $a + 1 = 1$ ii) $a \cdot a = a$

iii) $a \cdot (a + b) = a$ iv) $(\cdot a')' = a$

9. a) Let A = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} **8**
T = {(2, 3), (2, 1), (4, 5), (4, 6), (5, 8), (6, 7), (4, 2), (7, 9), (7, 10)}
Identify the root & show that T is a rooted tree. Also give corresponding binary tree.

b) Check whether the digraph given below are isomorphic. Find correspondence between the nodes. **8**



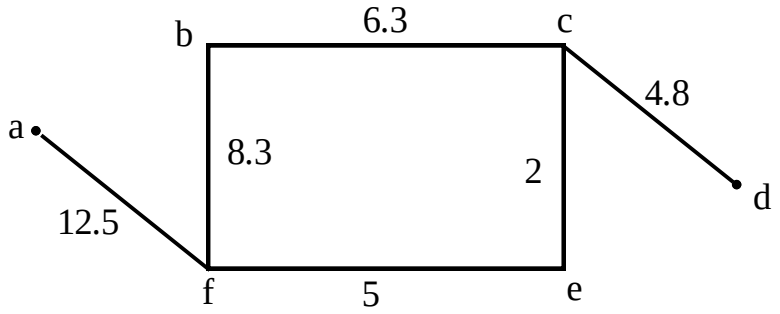
OR

10. a) Construct tree diagram corresponding to algebraic expression. **8**

i) $\{(3-(2x)\} + \{(x-2)-(3+x)\}+xy$

ii) $\big(2x+(3-4x)\big) + (x-(3\times 11)$

b) Using prim's algorithm find the minimal spanning tree of following weighted graph. **8**



****