



- Notes :
1. All questions are compulsory and carry equal marks.
 2. Draw neat and labelled diagram and use supporting data wherever necessary.
 3. Avoid vague answers and write specific answers related to questions.

Either :

1. a) Define sets and subsets. Explain the operation of sets with example. 8

- b) $A_1 = \{1, 2, 3\}$, $A_2 = \{2, 3\}$, $A_3 = \{1, 2, 3, 6\}$ then find $\bigcup_{i=1}^3 A_i$ and $\bigcap_{i=1}^3 A_i$. 8

OR

- c) Prove that statement is true by using mathematical induction 8

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}.$$

- d) Let $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ 8

a) Compute $A \vee B$

b) Compute $A \wedge B$

Either :

2. a) Define Pigeonhole principle using suitable example. 8

- b) To prove 8

i) $P(n, n) = 2 \times P(n, n-2)$

ii) $P(n, r) = P(n-1, r) + r \cdot P(n-1, r-1)$

OR

- c) Explain the following 8

i) Permutation function

ii) Cyclic permutation

- d) Consider the function $f, g : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2 + 3x + 1$, $g(x) = 2x - 3$ find the composition functions (i) $f \circ f$ (ii) $f \circ g$ (iii) $g \circ f$. 8

Either :

3. a) Define 8

i) Adjacent Node

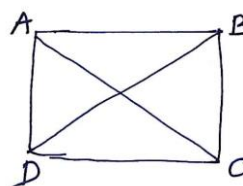
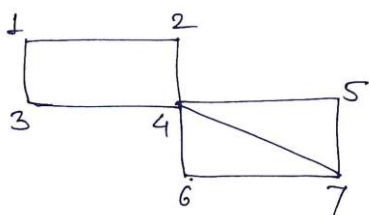
ii) Weighted Node

iii) Null graph

iv) Undirected graphs

- b) Determine whether the given graph is Hamiltonian or not. 8
If not give the answer.

i) ii)



OR

- c) Explain the following terms 8

- | | |
|-------------|--------------------------|
| i) Tree | ii) Height of tree |
| iii) Forest | iv) Complete Binary tree |

- d) Construct the tree 8

- i) $(3 - (2 - (11 - (9 - 4)))) \div (2 + (3 + (4 + 7)))$
 ii) $(7 + (6 - 2)) - (x - (y - 4))$

Either :

4. a) Define Group and Sub Group. Explain all the properties associated with group. 8

- b) Show that $(ab)^{-1} = b^{-1}a^{-1}$ for all $a, b \in G$. 8

OR

- c) Define Abelian Group. Explain Abelian Group properties associated with it. 8

- d) Let $(S, *)$ and $(T, *')$ be monoids with identities e and e' respectively. Let $f : S \rightarrow T$ be an isomorphism, then $f(e) = e'$. 8

5. Solve all the questions.

- a) Draw and explain truth table for conjunction, disjunction, conditional and biconditional statement. 4

- b) If ${}^nP_r = {}^nP_{r+1}$ and ${}^nC_r = {}^nC_{r-1}$ find the value of n and r . 4

- c) Explain Kruskal's Algorithm. 4

- d) Explain Homomorphism using suitable theorem for semigroup. 4
