

- b. Prove that a complete graph  $K_n$  is planar iff  $n \leq 4$ . 7M

(or)

8. a. How many vertices will the following graphs have if they contain?

i) 16 edges and all vertices of degree 2 7M

ii) 21 edges, 3 vertices of degree 4 and the other vertices of degree 3

iii) 24 edges and all vertices of same degree

- b. Find the chromatic number of the following graphs. 8M

i) Complete graph ( $K_n$ )

ii) Cycle graph ( $C_n$ )

iii) Tree

iv) Complete bipartite graph ( $K_{m,n}$ )

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DISCRETE MATHEMATICAL STRUCTURES

Time : 3 hours

Max. Marks : 70

Part-A is compulsory

Answer One Question from each Unit of Part-B

PART-A

10 x 1 = 10M

- Define Contradiction.
- Give an example for existential quantifier.
- How many ways can we get a sum of 8 when two distinguishable dice are rolled?
- Find the number of arrangements of letters in the word MATHEMATICS.
- Define partial ordering.
- Define cycle graph.
- Find the number of edges in complete graph ( $K_n$ ).
- Define Planer graph.
- Solve the recurrence relation  $a_n = a_{n-1} + n$  by substitution method given that  $a_0 = 2$ .
- Give an example for symmetric relation.

PART-B

4 x 15 = 60M

UNIT-I

1. a. Prove that the following implication is a Tautology. 8M  
 $\{ [p \rightarrow (q \vee r)] \wedge (\sim q) \} \rightarrow (p \rightarrow r)$
- b. Obtain the principal disjunctive normal form of 7M  
 $\bar{p} \rightarrow ((p \rightarrow q) \wedge \neg(\neg q \vee \neg p))$   
 (or)
2. a. Give a direct proof for the following implication. 8M  
 'If an integer  $a$  is such that  $a-2$  is divisible by 3, then  $a^2-1$  is divisible by 3'
- b. Symbolize the following argument and check for its validity 7M  
 Lions are dangerous animals  
 There are Lions  
 Therefore, There are dangerous animals

UNIT-II

3. a. Solve the following recurrence relation using generating functions 8M  
 $a_n - 9a_{n-1} + 20a_{n-2} = 0$  for  $n \geq 2$  and  $a_0 = -3, a_1 = -10$
- b. Find the coefficient of  $x^{20}$  in  $(x^3 + x^4 + x^5 + \dots)^5$  7M  
 (or)
4. a. Solve the following recurrence relation  $a_n - 6a_{n-1} + 8a_{n-2} = n4^n$  8M  
 given that  $a_0 = 8, a_1 = 2$ .

- b. In how many ways can 10 people be seated in a row so that a certain pair of them are not next to each other? 7M

UNIT-III

5. a. Show that the relation  $x \equiv y \pmod{m}$  is an equivalence relation on the set of integers. 8M
- b. Draw the directed graph for the relation  $\subseteq$  on all the non empty subsets of the set  $\{0, 1, 2\}$ . 7M  
 (or)
6. a. Draw the Hasse diagram for the poset  $(\{2, 4, 5, 10, 12, 20, 25\}, /)$  also find the maximal and minimal elements. 7M
- b. Define adjacency matrix and find the adjacency matrix for the following graphs. 8M  
 i)  $K_4$       ii)  $C_4$       iii)  $W_4$

UNIT-IV

7. a. Show that the following two graphs are isomorphic. 8M

