

Roll No. ....

Total Pages : 03

BT-6/M-14

8606

GRAPH THEORY AND COMBINATORICS

CSE-322

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) What is a cut-set ? State and prove various properties of a cut-set. 12
- (b) Prove that the maximum flow possible between two vertices  $a$  and  $b$  in a network is equal to the minimum of the capacities of all cut-sets with respect to  $a$  and  $b$ . 8
2. (a) Explain 1-isomorphism and 2-isomorphism in detail. 10
- (b) Explain the following in brief : 10
  - (i) Euler Graph
  - (ii) Hamiltonian Circuit
  - (iii) Spanning Tree
  - (iv) Graph.

## Unit II

3. State Polya's counting theorem. Explain with the help of suitable examples. How can simple graphs, multigraph and diagraph be enumerated using Polya's theorem ? Explain. 20
4. (a) What is Matching ? Prove that a complete matching  $V_1$  into  $V_2$  in a bipartite graph exists if and only if every subset of  $r$  vertices in  $V_1$  is collectively adjacent to  $r$  or more vertices in  $V_2$  for all values of  $r$ . 8
- (b) State and prove Max-Flow Min-Cut Theorem. 12

## Unit III

5. (a) How graphs can be represented in computer ? Explain with suitable examples. 10
- (b) What is a Fundamental Circuit ? Explain Paton's algorithm for finding the fundamental circuit. 10
6. (a) Write and explain the Warshall-Floyd algorithm for finding the shortest path. 10
- (b) Write and explain the depth-first search algorithm. 10

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## Unit IV

7. (a) Solve the following recurrence relation :10  
 $t_n = 0$  if  $n = 0$   
 $t_n = 5$  if  $n = 1$   
 $t_n = 3t_{n-1} + 4t_{n-2}$  Otherwise.
- (b) What is Generating Function ? Find the generating function for the Fibonacci series and explain. 10
8. (a) Explain how error detecting and correcting can be done with the help of Hadamard matrices. 10
- (b) What is a Multinomial ? Explain its use with the help of suitable examples. 10

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