

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 vartices 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

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