Roll No. .....

8606

BT-6/M-13

GRAPH THEORY & COMBINATORICS

Paper : 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) Discuss any *two* applications of graph in detail. 10

   (b) Prove that a connected graph G is an Euler's graph if and only if it can be decomposed into circuits. 10

2. (a) What do you understand by Hamiltonian path and circuit? Prove that in a complete graph with n vertices there are $(n-1)/2$ edge-disjoint Hamiltonian circuits, if n is an odd number $>= 3$. 10

   (b) Prove that the ring sum of any two cut-sets in a graph is either a third cut-set or an edge-disjoint union of cut-sets. 10

UNIT–II

3. (a) Differentiate between Planar and Non-planar graphs. Describe various representations of planar graph. 10

   (b) Show that the chromatic polynomial of a graph of n vertices satisfies the inequality $Pn(\lambda) <= \lambda(\lambda-1)^{n-1}$. 10

4. (a) Explain enumeration of simple graphs, multigraph and digraphs using Polya's theorem. 10

(b) Prove that every complete tournament has a directed Hamiltonian path. 10

UNIT–III

5. (a) Discuss and compare the performance of various graph theoretic algorithms. 10

(b) Explain Dijkstra's algorithm for finding shortest path with the help of an example. 10

6. Write down the algorithm for Planarity Testing. Also discuss the circuit-path decomposition in detail with appropriate examples. 20

UNIT–IV

7. (a) State Pigeonhole principle. Explain the principle with the help of suitable examples. 10

(b) Solve the following recurrence relation :

$$C_n = 2C_{n-1} + 1, \text{ if } n > 1 \text{ and } C_1 = 1.$$ 10

8. Explain the following in detail :

(a) Generating functions.

(b) Hamming code for error detection and correction. 20