

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII EXAMINATION – WINTER 2025

Subject Code:3171611

Date:20-11-2025

Subject Name:Graph Theory and Combinatorics

Time:10:30 AM TO 01:00 PM

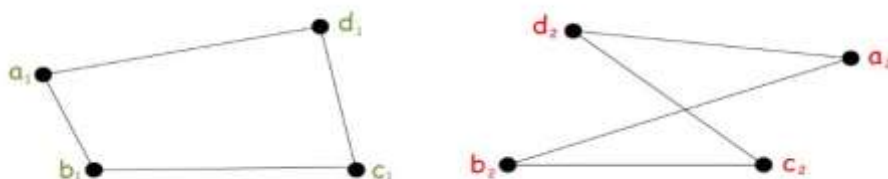
Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1 (a) Define Graph, planar graph and subgraph. 03
- (b) Define isomorphism. Determine whether the following pair of graphs are isomorphic. 04



- (c) Describe Königsberg Bridge Problem with respect to graph theory. 07

- Q.2 (a) Define tree? List out the applications of tree? 03
- (b) What is graph coloring? Explain Greedy coloring. 04
- (c) Prove that the number of vertices of odd degree in a graph is always even. 07
Also, take any graph and verify it.

OR

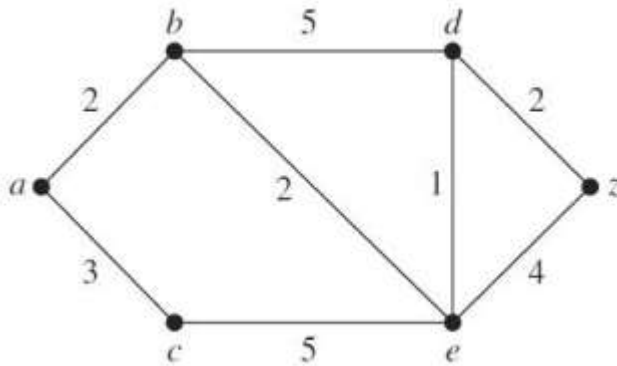
- (c) Prove that a simple graph with n vertices and k components can have most $\frac{(n-k)(n-k+1)}{2}$ edges. 07

- Q.3 (a) Differentiate Permutation & Combination with proper example. 03
- (b) In how many different ways can you arrange the letters of the word COMPUTER taking 4 at a time? 04
- (c) Explain the stable matching problem. 07

OR

- Q.3 (a) Define edge vertex connectivity and edge connectivity. Give the relation between them. 03
- (b) There are 9 students in a club. Three students are to be chosen to be on the entertainment committee. In how many ways can this group be chosen? 04
- (c) Describe Hall's marriage theorem. 07

- Q.4 (a)** Explain Inclusion – Exclusion Principle. **03**
- (b)** What is Rook Polynomial? Explain expansion formula of it. **04**
- (c)** Find the length and shortest path between a and z in each of the weighted graphs Using Dijkstra's algorithm. **07**



OR

- Q.4 (a)** Write applications of Transport Network. **03**
- (b)** Give an example of following: **04**
- 1) A graph that has an Eulerian circuit but no Hamiltonian Circuit
 - 2) A graph that has a Hamiltonian circuit but no Eulerian circuit.
- (c)** Explain Catalan numbers with suitable examples. **07**
- Q.5 (a)** Define de Bruijn graph. **03**
- (b)** What is recurrence relation? Explain different types of recurrence relation. **04**
- (c)** Solving Recurrence Relation $a_n = 7a_{n-1} - 10a_{n-2}$ with $a_0 = 2$ and $a_1 = 3$. **07**

OR

- Q.5 (a)** Define Derangements. **03**
- (b)** Among 150 college students, 83 own cars, 97 own bike, 28 own motorcycles, 53 own a car and a bike, 14 own a car and a motorcycle, 7 own a bike and a motorcycle, and 2 own all three. **04**
- a. How many students do NOT own any of the three?
 - b. How many students own a bike and nothing else?
- (c)** Solve the recurrence relation $a_n = 3a_{n-1} + 2a_{n-2}$ subject to $a_0 = 1$. **07**
