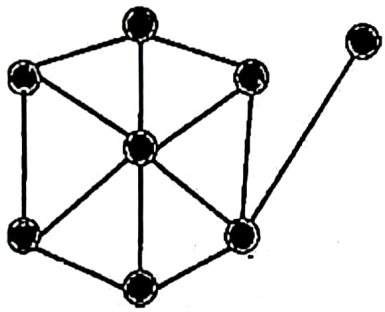
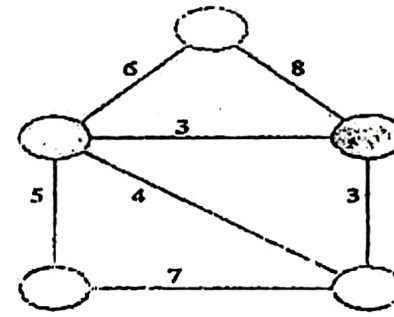
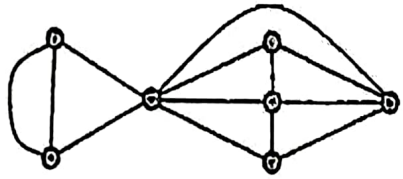
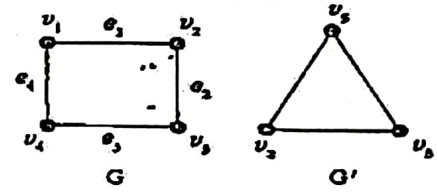
Bachelor Of Engineering In Information Technology
2nd Year 2nd Semester, Semester Examination, 2022
Subject Name –Graph Theory & Combinatorics (IT/PC/B/T/224)
Full Marks=100

CO1 [10]	Q1. (i) Show that the number of vertices of odd degrees in a graph is always even with a suitable example. (ii) In a group of thirteen (13) persons is it possible that everyone has a friendship with exactly seven (7) in the group? Justify this. [5+5=10]
CO2 [20]	Q2. (i) Find and draw the Hamiltonian path and Hamiltonian circuit of the graph given below (Figure: 1) if possible. Justify this if not possible. (ii) Show that a Hamiltonian path is a spanning tree using a suitable example. (iii) Using Prim's algorithm finds the minimal spanning tree of the graph given below (Figure: 2).  Figure: 1  Figure: 2 [6+8+6=20]
CO3 [20]	Q3. (i) Find the vertex connectivity and edge connectivity of the graph given below (Figure: 3). (ii) Find the union of the two graphs G and G` given below (Figure: 4). (iii) Explain the Fundamental cut sets with a suitable example.  Figure: 3  Figure: 4 [8+6+6=20]
CO4 [20]	Q4. (i) "A graph is 2-colorable if it is bipartite and every cycle has an even length." Justify this with a suitable example. (ii) Find the chromatic number of the graph given in the next page (Figure: 5). (Mention all steps properly) (iii) Find out how many vertices can be matched using maximum matching in the bipartite graph algorithm of the following graph given in the next page (Figure: 6)?

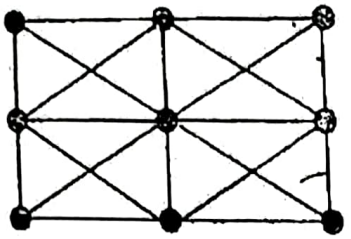


Figure: 5

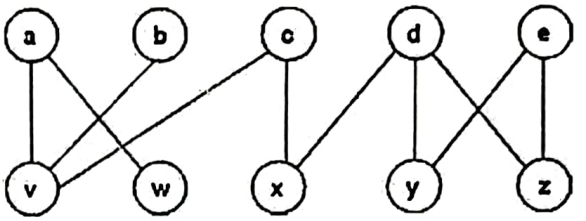


Figure: 6 [6+6+8=20]

CO5 [20]

Q5. (i) There are 50 microcomputers in a computer center. Each microcomputer has 30 ports. How many different ports to a microcomputer in the center are there?

(ii) Suppose that there are eight runners in a race. The winner receives a gold medal, the second place finisher receives a silver medal, and the third-place finisher receives a bronze medal. How many different ways are there to award these medals, if all possible outcomes of the race can occur and there are no ties?

(iii) Suppose that a department contains 10 men and 15 women. How many ways are there to form a committee with six members if it must have more women than men?

[5+8+7=20]

CO6 [10]

Q6. (i) Find the generating functions of the following sequences in closed form

<1, 4, 9, 16, 25, ...>?

(ii) Find the sequence generated by the following generating functions:

$$\frac{4x}{1-x}.$$

[5+5=10]

CO1: Explain and **discuss** the concept of different types of Graphs with fundamental properties and **express** different types of matrix representation. (K2)

CO2: Illustrate different types of trees such as (i) rooted tree (ii) spanning tree etc, and **explain** their properties. (K3)

CO3: Apply operations like Union, Deletion, and decomposition of graphs and **illustrate** Cut vertex and Cut edge and their properties. (K3)

CO4: Illustrate planar graph and their properties and Graph Coloring and Matching. (K3)

CO5: Apply and **evaluate** basic counting rules, pigeon-hole principle and principle of inclusion-exclusion. (K3)

CO6: Apply and **Solve** problems using Generating Function and Recurrence Relations. (K3)