Name:

Enrolment No:

UPES

End Semester Examination, May 2025

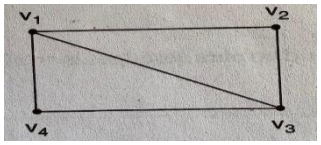
Course: Graph Theory **Semester:** IV

Program: B.Sc. (Hons) Mathematics by Research **Time: 03 hrs.**

Course Code: MATH2025K **Max. Marks: 100**

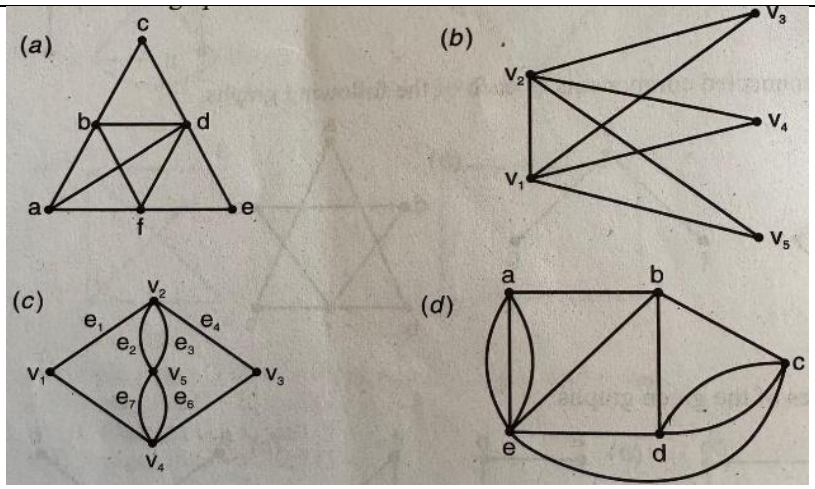
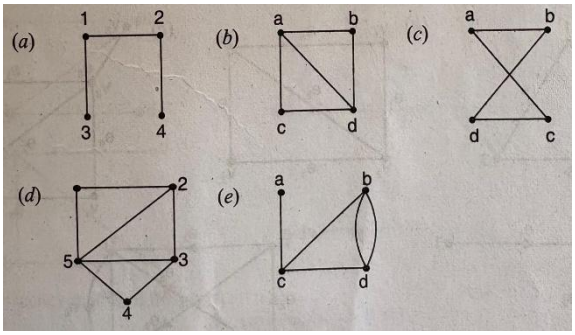
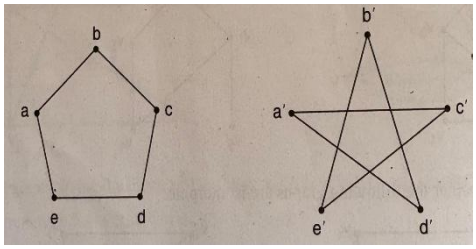
Instructions: Attempt all questions from Section A, Section B and Section C. There are internal choices in Questions 9 and 10. Use of a scientific calculator is permitted.

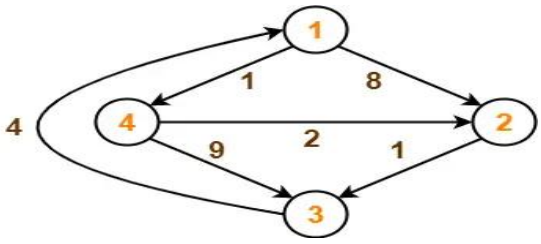
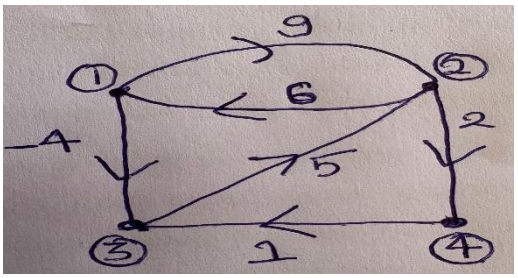
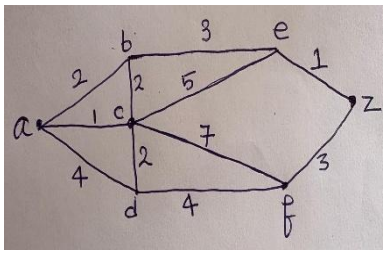
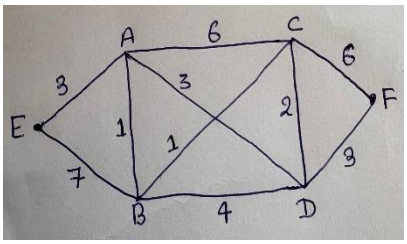
SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Show that the number of vertices of odd degree in a graph is always even.	**4**	**CO3**
Q 2	Draw the graph of the chemical molecules of propane (C_3H_8).	**4**	**CO1**
Q 3	What is the difference between trial and circuit in graph theory?	**4**	**CO2**
Q 4	Use adjacency matrix to represent the graph shown in the following figure:  Figure 1: Simple Graph	**4**	**CO1**
Q 5	How many vertices and how many edges do the following graphs have? (a) K_n (b) W_n	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Suppose G is a non-directed graph with 12 edges. If G has 6 vertices each of degree 3 and rest have degree less than 3, find the minimum number of vertices G can have.	**10**	**CO3**
Q 7	Determine which of the following graphs contain an Eulerian circuit. If it does, find the Eulerian circuit for the graph.	**10**	**CO2**

	 Figure 2: Set of graphs		
Q 8	Find the adjacent matrix of each of the following graphs:  Figure 3: Set of graphs.	**10**	**CO1**
Q 9	Check whether the following graphs are isomorphic or not?  Figure 4: Pair of graphs. **OR** Find the graph represented by the following adjacent matrices: a. $\begin{bmatrix}0&1&0&1\\1&0&1&0\\0&1&0&1\\1&0&1&0\end{bmatrix}$ b. $\begin{bmatrix}0&1&0&1&0\\1&0&1&0&1\\0&1&0&1&1\\1&0&1&0&0\\0&1&1&0&0\end{bmatrix}$	**10**	**CO1**

	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices from the following graph.  Figure 5: Directed Weighted Graph. **OR** Find all pair shortest distance matrix using Floyd Warshall Algorithm from the following directed graph:  Figure 6: Directed Weighted Graph.	**20**	**CO3**
Q 11	Use Dijkstra's algorithm to find the shortest path between *a* and *z* and between E and F in figure 7 and figure 8, respectively.  Figure 7: Weighted Graph  Figure 8: Weighted graph	**10+10**	**CO3**