Name:
Enrollment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Online End Semester Examination, May 2021

Programme Name: B. Sc Mathematics **Semester : IV**
Course Name : Graph Theory **Time : 03 hrs**
Course Code: MATH 2025 **Max. Marks : 100**

Section A
(All questions are compulsory)

1	An undirected connected graph has a total of 27 edges, of which 6 vertices are of degree 2, 3 vertices are of degree 4, and the remaining vertices are of degree 3. The total number of vertices in the graph is A 19 B 11 C 09 D 13	**[5]**	**CO3**
2	The number of vertices in a K_6 graph is A 6 B 5 C 4 D 3	**[5]**	**CO1**
3	Consider the following two claims: Claim I: If G is a bipartite graph with a finite (>0) number of edges, then G is 2-colorable. Claim II: If G is bipartite with no edges, it is 1-colorable. Then it can be inferred that A Both claims I and II are true. B Only claim I is true. C Only claim II is true. D Both claims I and II are false.	**[5]**	**CO1**

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4	Consider the following three claims: Claim I: The complement of a cycle on 25 vertices has an Eulerian circuit. Claim II: Any k-regular graph, where k is an even number, has an Eulerian circuit. Claim III: A complete graph on 90 vertices has an Eulerian circuit. Then it can be inferred that A Only claim I is true. B Only claim II is true. C Only claims II and III are true. D All claims are false.	**[5]**	**CO2**
5	Draw a simple undirected graph, G, such that some vertices of G are of odd degree. Now add a node v to G such that v is adjacent to each odd degree vertex of G. The resultant graph is A Eulerian B Regular C Complete D Hamiltonian	**[5]**	**CO2**
6	The traveling salesman problem is about finding A minimum cost Hamiltonian cycles B minimum cost Eulerian cycles C maximum cost Hamiltonian cycles D maximum cost Eulerian cycles	**[5]**	**CO2**

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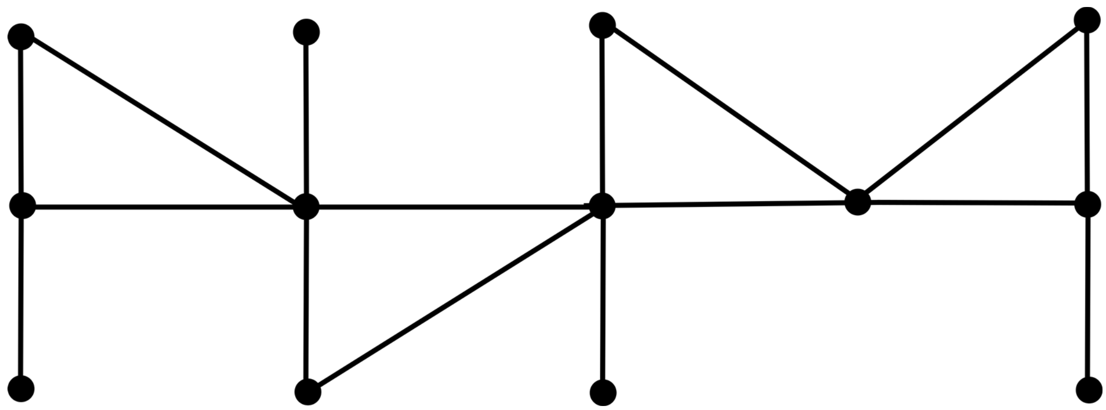
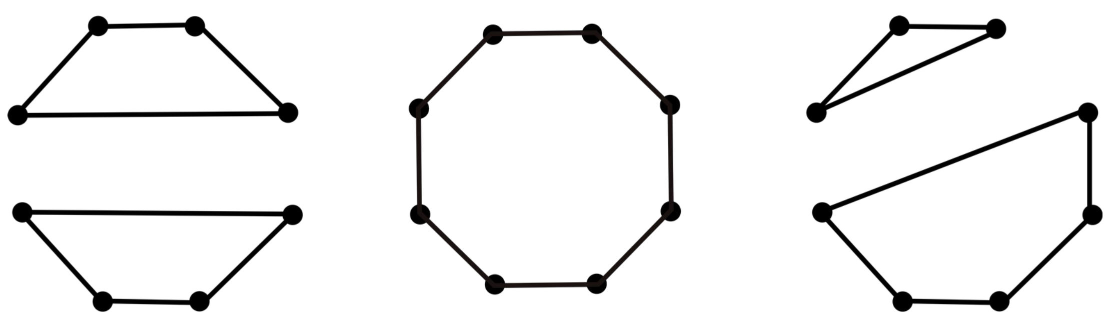
SECTION B

(Q1-Q5 are compulsory and Q5 has internal choices)

1	Find the radius, diameter, centre, circumference, and girth of the graph shown below. 	**[10]**	**CO1**
2	Three simple graphs, G, H, and I are shown below. Examine the isomorphism of the three pairs of the graphs; G and H, G and I, and H and I. Justify your conclusions with sufficient proofs.  **G** **H** **I**	**[10]**	**CO3**

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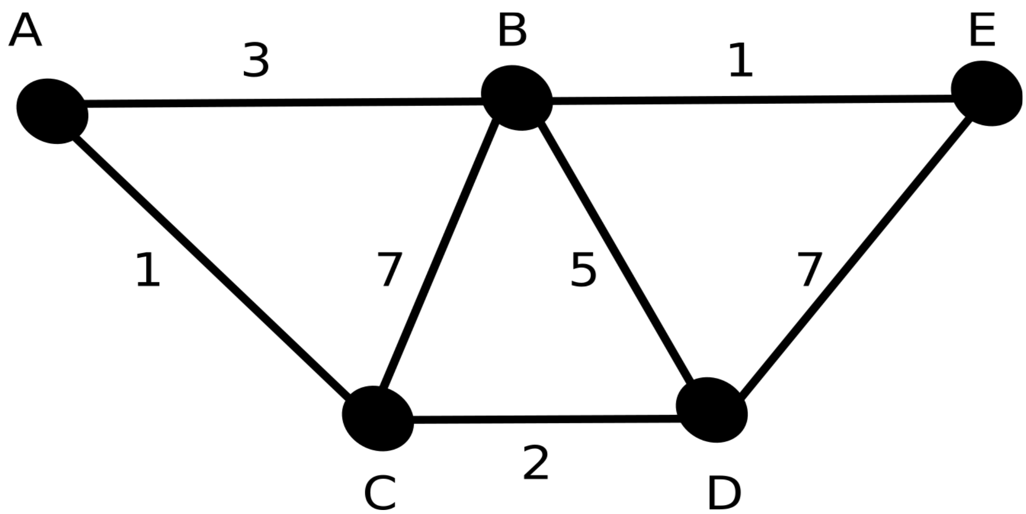
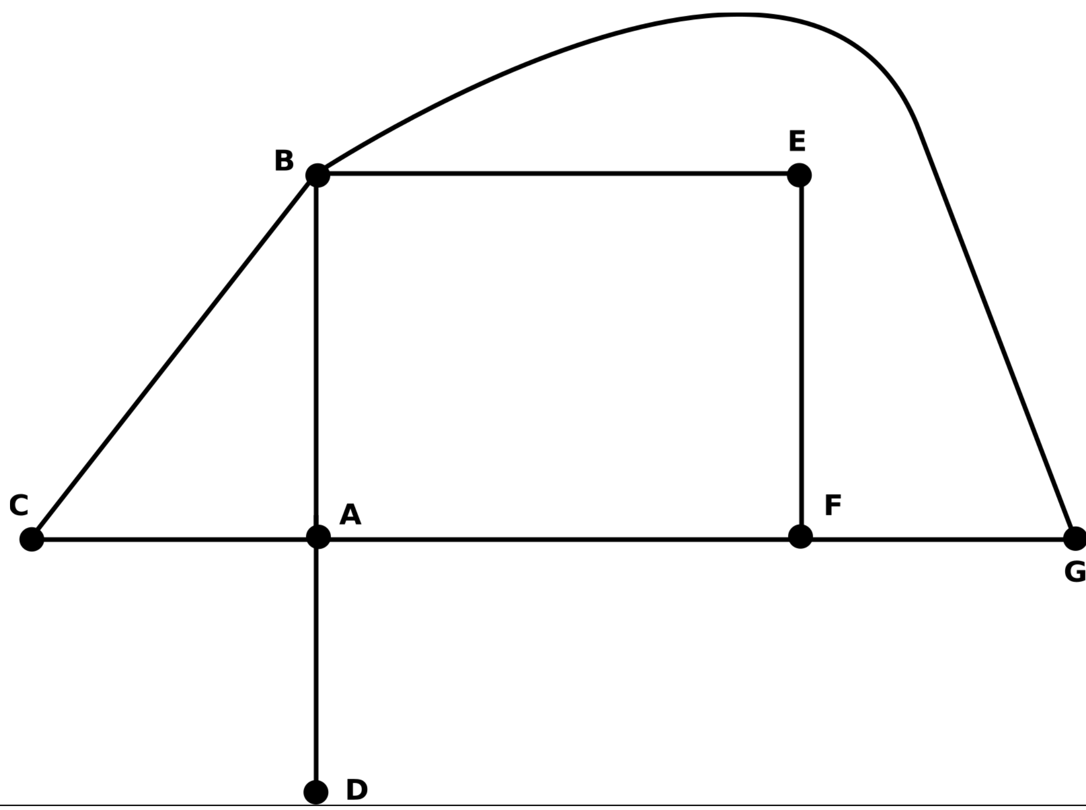
3	Use Dijkstra's algorithm to calculate the shortest path between the node D and the other nodes in the graph shown below. 	**[10]**	**CO2**
4	Implement Fleury's algorithm on the following graph and obtain an Eulerian circuit. 	**[10]**	**CO2**

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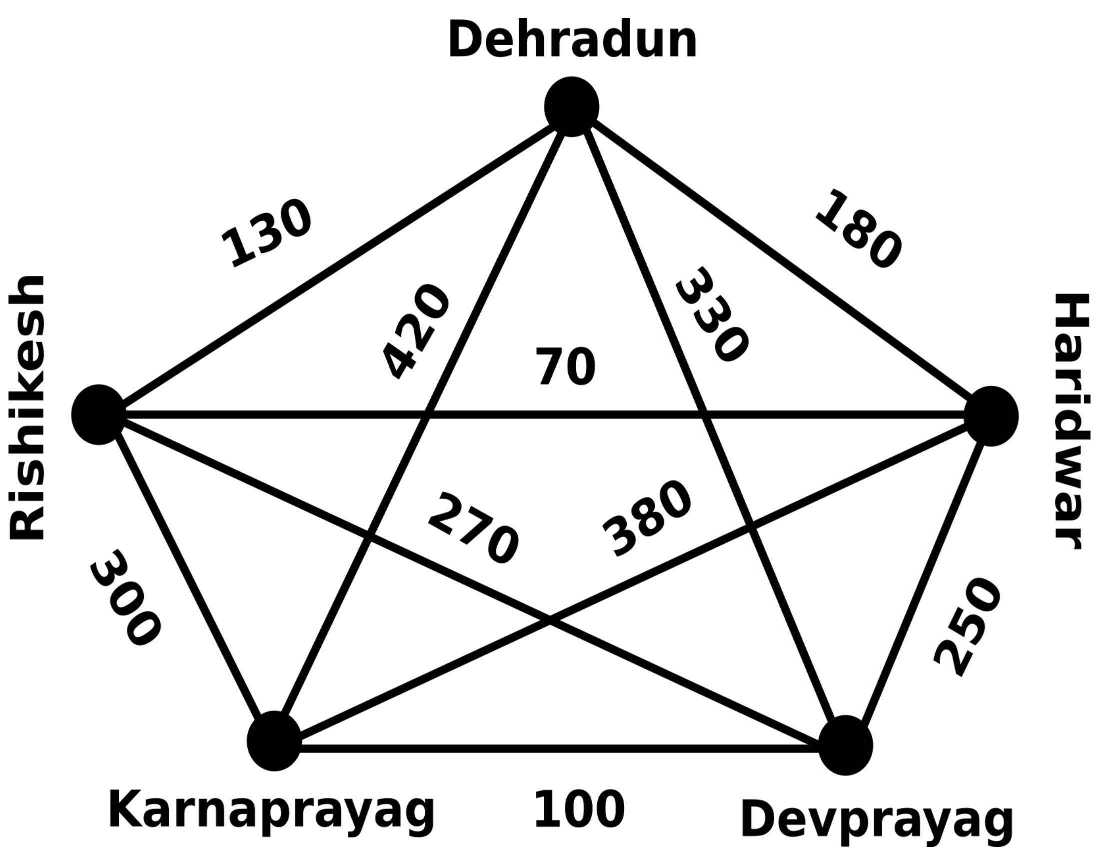
5	Prove that if G is a graph in which the degree of each vertex is at least 2, then G contains a cycle. **OR** State and prove Ore’s theorem.	**[10]**	**CO3**
	SECTION C **(Q1 is compulsory and has internal choices)**		
1	Vikash lives in Dehradun and plans to visit the four touristic cities in its neighborhood. He looks up the bus-fares between each city, and puts the cost in a graph as shown below. Use the nearest neighbor method as well as the greedy approach algorithm to determine the order in which he should travel from his hometown to visit each city exactly once and then return to his hometown with the lowest cost. Comment on the optimality of your solutions.  	**[20]**	**CO2**

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OR

Use Floyd-Warshall's algorithm to find the shortest path between all the pairs of vertices in the weighted graph shown below.