
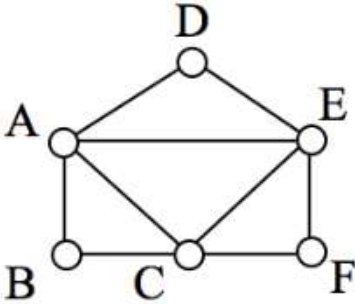


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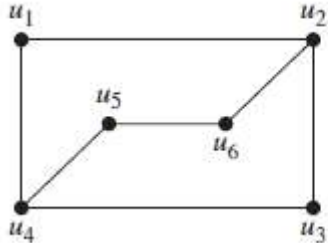
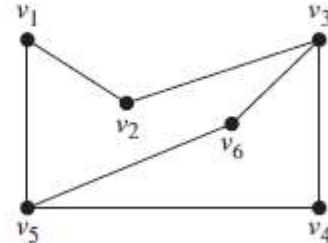
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022	
Course: Graph Theory Program: B.Sc H Mathematics Course Code: MATH2025K	Semester: IV Time : 03 hrs. Max. Marks: 100
Instructions: Attempt all the questions.	

SECTION A (5Qx4M=20Marks)
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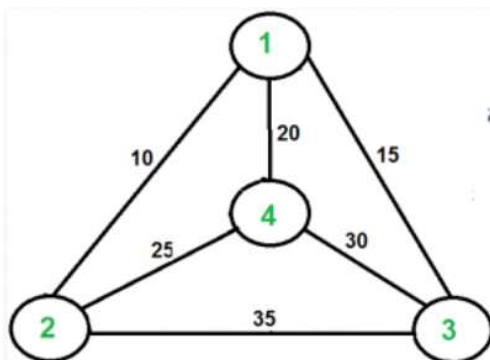
S. No.		Marks	CO
Q1.	Define the following with relevant examples (a) Multigraph (b) Directed graph (c) Complete graph (d) Pseudograph	4	CO1
Q2.	(a) Describe the ‘degree sequence’ of a graph. (b) Draw a multigraph with the degree sequence (5,5,4,3,2,1).	4	CO1
Q3.	Show that the maximum number of edges in a simple graph with n number of vertices is $\frac{n(n-1)}{2}$.	4	CO3
Q4.	Define Euler circuit and find at least two Euler circuits from the following graph. <div style="text-align: center; margin: 10px 0;">  </div>	4	CO2

Q5.	<p>Define incidence matrix and draw a digraph from the following incidence matrix.</p> $\begin{bmatrix} -1 & 0 & 0 & 1 & -1 & 0 & 0 & -1 \\ 1 & -1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & -1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & -1 & 0 & -1 & -1 & 1 \end{bmatrix}$	4	CO2
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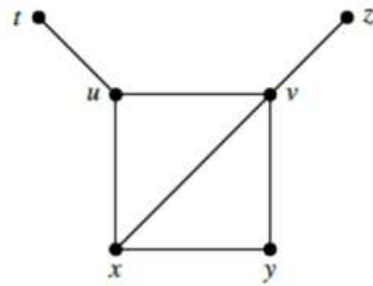
SECTION B
(4Qx10M= 40 Marks)

Q6.	<p>Define Isomorphism of graphs and check whether the following graphs G and H given below are isomorphic or not by means of a function $f:V(G) \rightarrow V(H)$. Also, verify your answer by means of adjacency matrices of the graphs G and H.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>G</p> </div> <div style="text-align: center;">  <p>H</p> </div> </div>	10	CO1
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Q7.	<p>Draw the following graphs.</p> <ol style="list-style-type: none"> A graph that has an Eulerian circuit but not a Hamiltonian circuit. A graph with distinct Eulerian and Hamiltonian circuits. A graph that has a Hamiltonian circuit which is also an Eulerian circuit. A graph that has neither an Eulerian circuit nor a Hamiltonian circuit. 	10	CO2
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Q8.	<p>Apply the Naïve method to obtain the minimum weight Hamiltonian cycle(s) starting with the vertex 1 of the graph given below.</p> <div style="text-align: center;">  </div>	10	CO2
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Consider the following graph.



- (i) Illustrate the graph obtained by the fusion of the vertices u and v .
- (ii) Illustrate the complement of the above graph.
- (iii) Identify whether this graph is bipartite or not. If yes, obtain its bipartite version.

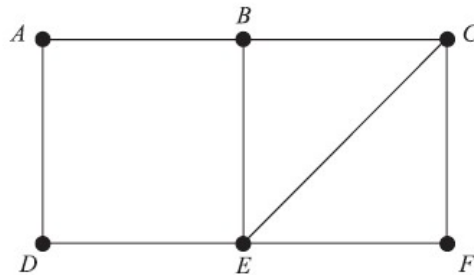
Q9.

10

CO3

(OR)

Consider the following graph.

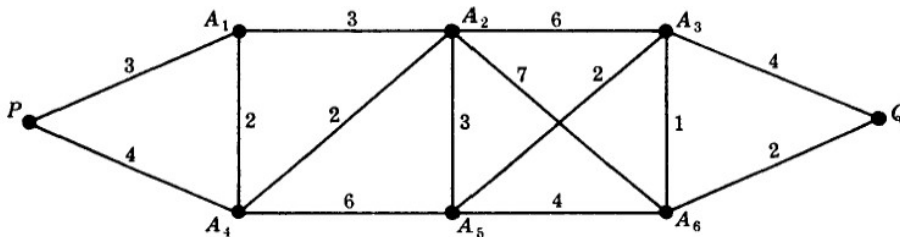


Discuss whether this graph has any cut vertices by obtaining all the subgraphs when each vertex is deleted.

SECTION-C
(2Qx20M=40 Marks)

Apply Dijkstra's algorithm on the following graph to determine the length of the shortest path and hence the shortest path from the vertex P to vertex Q .

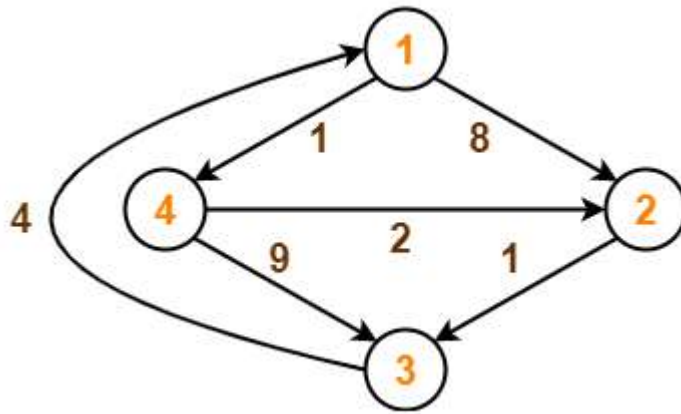
Q10.



20

CO2

Apply Floyd Warshall algorithm on the following graph and find the shortest path distance between every pair of vertices.



Q11.

(OR)

An ice cream company has a distribution depot D in a city from which it has to supply ice cream to four of its vendors say $V_1, V_2, V_3,$ and V_4 located in different parts of the city. The following table gives the distance in kilometers between the depot and the location of its four vendors.

20M

CO3

	D	V_1	V_2	V_3	V_4
D	∞	3.5	3	4	2
V_1	3.5	∞	4	2.5	3
V_2	3	4	∞	4.5	3.5
V_3	4	2.5	4.5	∞	4
V_4	2	3	3.5	4	∞

Design the route for the company van so that it visits each vendor once and only once and reaches back to the depot covering the least possible distance.
