K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:I
Class:PG-I	Program:MCA
Branch Code:M.C.A.	Pattern:2024
Name of Course:Discrete Mathematics	Course Code:2409501
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

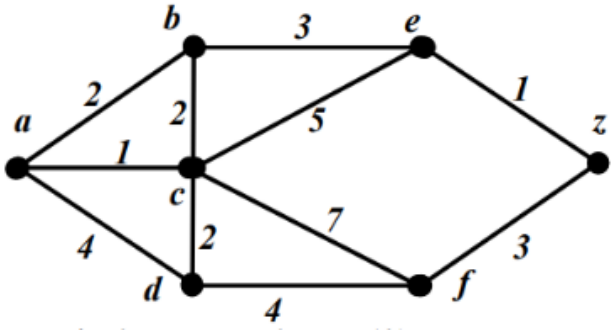
1. This question paper contains _03__page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	**CO**
Question No. 1			
1a)	Prove the following using truth tables: i) $(P \wedge Q) \vee (\neg P) \equiv Q$ ii) $P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$	(6)	CO1
Question No. 2			
2a)	Let A = {1,2,3,4} and R= {(1,2) , (2,1), (2,3), (3,4) }. Find the transitive closure of R using Warshall's Algorithm.	(6)	CO2
Question No. 3			
3a)	A password consists of 4 distinct letters followed by 2 digits (0–9). (a) Find the total number of such passwords if letters cannot repeat but digits can repeat. (b) If the first letter must be a vowel, how does the count change? Show step-by-step permutation reasoning.	(8)	CO3
	OR		
3b)	A committee of 5 members is to be formed from 8 men and 6 women. (a) In how many ways can the committee be formed such that it includes at least 2 women? (b) What change occurs if the committee must include exactly 3 women? Apply combinations and explain the logic.	(8)	CO3
3c)	In how many ways can the letters of the word "SUCCESS" be arranged: (a) Without any restriction? (b) Such that the two C's are always together? Use appropriate permutation formulas for repeated letters.	(8)	CO3
	OR		
3d)	In how many distinct ways can 7 people be seated around a round table if: (a) There is no restriction	(8)	CO3

(b) Two particular persons must always sit together
Explain the concept of circular permutations in detail.

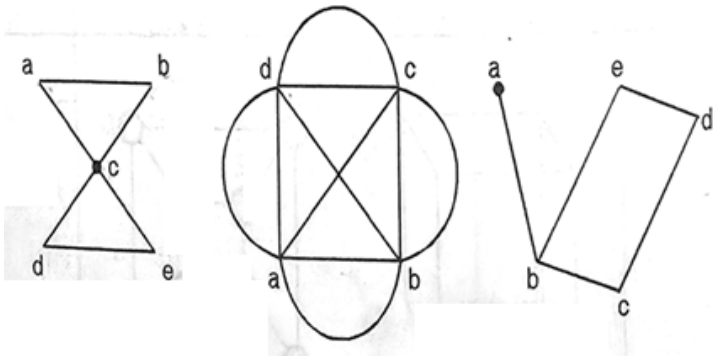
Question No. 4

4a) Find shortest path from the vertex a to vertex z of graph G using Dijkstra's Algorithm (8) CO4



OR

4b) Which of the following graph have a Euler Circuit or path or Hamiltonian cycle? Write the path or circuit and justify your answer. (8) CO4



4c) Define and explain the following concepts with suitable diagrams: (8) CO4
i) Complete Graph
ii) Isomorphic Graph
iii) Directed Acyclic Graph (DAG)
iv) Bipartite Graph

OR

4d) Represent the following scenario using both adjacency matrix and adjacency list: (8) CO4
A social network has 5 users (A, B, C, D, E). Friendships exist between: A–B, A–C, B–C, C–D, D–E.
Draw the graph and compare advantages of both representations.

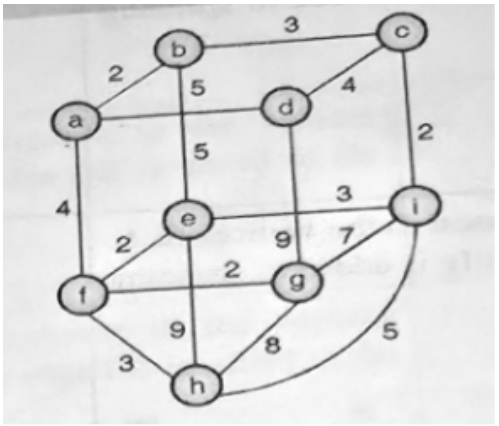
Question No. 5

5a) Draw a binary search tree for input data (8) CO5

200,100,300,50,150,250,400,10,75,125,175. Which is a root, leaf nodes and interior nodes 2.

OR

5b) Find the Minimum Cost Spanning Tree of the following graph using Prim's Algorithm. (8) CO5



5c) Find the Minimum Cost Spanning Tree of the graph with the following cost Matrix using Kruskal's Algorithm. (8) CO5

	A	B	C	D	E	F	G
A	0	12	0	14	11	17	8
B	12	0	9	0	12	10	9
C	0	9	0	18	14	0	9
D	14	0	18	0	0	23	14
E	11	12	14	0	0	16	0
F	0	15	31	6	15	8	16
G	17	10	0	23	16	0	22
H	8	9	9	14	0	22	0

OR

5d) Discuss the Huffman coding technique for generating optimal prefix codes. Why is Huffman code considered optimal? (8) CO5

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