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:V
Class:TY	Program:B.Tech
Branch Code:ADS/COM/CSD	Pattern:2023
Name of Course:Data Structures and algorithms	Course Code:2301301
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 3 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			
a)	Write Kruskal's Algorithm for finding a Minimum Spanning Tree (MST). Also, mention its time and space complexity. Using the given weighted graph, illustrate step-by-step how Kruskal's Algorithm selects edges to construct the Minimum Spanning Tree. Graph: Vertices: ({A, B, C, D, E}) Weighted edges: ((A,B,4), (A,C,2), (B,C,3), (B,D,6), (C,D,5), (C,E,1), (D,E,7))	(6)	CO1
Question No. 2			
b)	Given the following inorder and postorder sequences of nodes (a) Inorder: D B F E A G C L J H K (b) Postorder: D F E B G L J K H C A Using this information: 1. Reconstruct the original rooted binary tree step by step. 2. Construct an algorithm from steps you applied	(6)	CO2
Question No. 3			
a)	Construct an AVL Tree by inserting the following 12 keys in the given order. Show all intermediate steps, including LL, RR, LR, or RL rotations wherever required. Keys: 50, 25, 75, 12, 37, 62, 87, 6, 18, 31, 43, 93 1. Insert each key into the AVL tree in sequence. 2. Show the balance factor after each insertion. 3. Perform required rotations and draw the final AVL tree.	(8)	CO3

OR

b) Construct a B-Tree of order 5 by inserting the following keys sequentially: (8) CO3

Keys: 50, 85, 42, 10, 16, 60, 70, 80, 87, 100, 120, 65, 150, 62, 30, 17, 18, 28, 75, 78.

1. Insert each key step-by-step and show all node splits clearly.

2. Draw the final B-Tree after all insertions.

3. State the best-case and worst-case time complexity of insert and delete operations in a B-Tree.

c) Write an algorithm to delete a node from B tree (8) CO3

OR

d) For the following keys 11, 19, 17, 5, 80, 14, 1, 10, 23 (8) CO3

1. Build a binary max-heap from the above sequence inserting one element at a time using the standard insertion method

2. Show the array representation of the heap after each insertion

3. Also show the tree diagram of the heap after the final build.

4. Mention the time and space complexity of Insert operation

Question No. 4

a) Explain the Job scheduling algorithm using the Greedy Approach Using a suitable example. (6) CO4

OR

b) Explain Fractional Knapsack Problem using the Greedy Approach using a suitable example (6) CO4

c) Find an OBST using a dynamic programming for n = 4 and keys (k1 < k2 < k3 < k4) = (case, else, for, switch) (10) CO4

given that p(1:4) = (3, 3, 1, 1) and q(0:4) = (2, 3, 1, 1, 1).

OR

d) Consider the following instance of the 0/1 Knapsack problem. Determine the optimal profit and the items selected using the Dynamic Programming approach (10) CO4

Knapsack Capacity = 6

Item	Weight	Profit
1	1	$8
2	3	$14
3	4	$16
4	2	$12

1 Construct the Dynamic Programming table.

2 Show intermediate steps clearly.

3 Identify which items are included in the optimal solution.

4 State the maximum profit obtained.

Question No. 5

a) State the graphcoloring problem. Write an algorithm to solve this problem using backtracking method (5) CO5

OR

b)	What is backtracking method? Explain in detail	(5)	CO5
c)	Construct a solution for the **4 queens** problem using the "least possible conflict" heuristic. Demonstrate how you choose each queen's position and justify why each placement avoids row, column, and diagonal conflicts.	(5)	CO5

OR

d)	Compare backtracking method and Branch and Bound method	(5)	CO5
e)	Explain the sum of subsets problem with example	(6)	CO5

OR

f)	Explain the TSP problem with example	(6)	CO5

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