



**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 DFS Algorithm. Also, mention its time and space complexity. (6) CO1

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))

**Question No. 2**

- b) Given the following inorder and postorder sequences of nodes (6) CO2

(a) Inorder: D B E A C F

(b) Postorder: D E B F C A

Using this information:

1. Reconstruct the original rooted binary tree step by step.
2. Construct an algorithm from steps you applied

**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: 35, 20, 40, 10, 25, 50, 5, 15, 22, 28, 45, 55 (8) CO3

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.

**OR**

- b) Construct a B-Tree of order 5 by inserting the following keys sequentially: (8) CO3  
Keys: 40, 22, 10, 50, 90, 35, 60, 75, 12, 18, 65, 95, 120, 130, 32, 28, 14, 20, 55, 80
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 search the element in a B tree (8) CO3

**OR**

- d) For the following keys 17, 5, 80, 14, 1, 10, 23, 34, 22 (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 Activity selection problem using the Greedy Approach with suitable example. (6) CO4

**OR**

- b) Explain the Job scheduling algorithm using the Greedy Approach Using a suitable example. (6) CO4
- c) Find an OBST using a dynamic programming for  $n = 4$  and keys  $(k_1 < k_2 < k_3 < k_4) = (\text{auto}, \text{char}, \text{float}, \text{return})$  given that  $p(1:4) = (3, 3, 1, 1)$  and  $q(0:4) = (2, 3, 1, 1, 1)$ . (10) CO4

**OR**

- d) Solve the following Knapsack problem using the Dynamic Programming technique. (10) CO4

Knapsack Capacity = 7

Item	Weight	Profit
1	2	\$18
2	3	\$25
3	4	\$30
4	5	\$35

- 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 sum of subsets problem. Write an algorithm to solve this problem using backtracking method (5) CO5

**OR**

- b) Compare backtracking method and Branch and Bound method (5) CO5
- c) Apply the recursive backtracking algorithm to generate any one valid solution of the **4 queens** problem. Draw the chessboard for placing **4 queens** successfully and explain the checks used to avoid conflicts. (5) CO5

**OR**

- d) What is Branch and Bound method? Explain in detail. (5) CO5
- e) Explain the TSP problem with example (6) CO5

**OR**

- f) Explain the Graph coloring problem with example (6) CO5

..... **End of question paper**.....