

SE Sem III NEP INF 7 May 2026,

Duration: 2hrs

[Max Marks:60]

6/6/26

- N.B.: (1) Question No 1 is Compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) All questions carry equal marks.
 (4) Assume suitable data, if required, and state it clearly.

1 Attempt any THREE**[15]**

- a Define an AVL tree. Explain the concept of rotations in AVL trees.
 b Apply Fractional Knapsack algorithm for the following data:
 Items: A, B, C, D
 Profits: 40, 50, 100, 90
 Weights: 10, 20, 30, 30
 Knapsack Capacity: 60
 c Solve the 4-Queens problem using backtracking and show one valid board arrangement.
 d Differentiate between 0/1 Knapsack and Fractional Knapsack.

- 2 a Solve the recurrence relation using recursion tree method: $T(n) = 3T(n/4) + n^2$ [07]

- b Insert the following keys into a B-tree of order 5. [08]
 Show the tree after each split: 25, 37, 80, 10, 65, 50, 60, 90, 70, 85

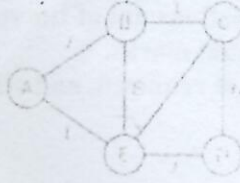
- 3 a Given $n=7$ items with profits $p=\{10,5,15,7,6,18,3\}$, weights $w=\{5,2,3,5,7,2,4\}$, and knapsack capacity $m=15$, solve the fractional knapsack problem using the greedy profit/weight ratio rule and report the optimal total profit and the fraction of each item selected ($x_1, \dots, x_7$). [07]

- b Apply backtracking to find all subsets with sum 15 from the set: [08]
 $\{1, 3, 5, 7, 9, 11\}$

- 4 a Given a weighted directed graph with 4 vertices, apply the Floyd-Warshall's algorithm to compute the all-pairs shortest path matrix. [07]

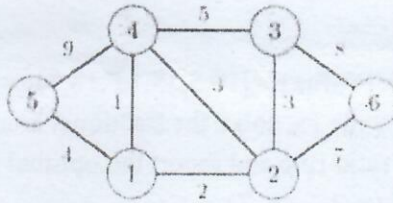
Fro m / To	1	2	3	4
1	0	3	∞	7
2	8	0	2	∞
3	5	∞	0	1
4	2	∞	∞	0

- b Using Dijkstra's Algorithm to determine the shortest path from source node A to all other nodes. Show the detailed working. [08]



- 5 a Given the following adjacency list, perform BFS and DFS starting from A: [07]
 A: B, C
 B: A, D, E
 C: A, F
 D: B
 E: B, F
 F: C, E
 b Explain KMP (Knuth–Morris–Pratt) algorithm. Then use this to perform pattern [08]
 matching on the text T = "BACBABABABACACA" and pattern P =
 "ABABACA".

- 6 a Apply Prim's Algorithm and Kruskal's Algorithm on the following weighted [07]
 graph and find the Minimum Spanning Tree (MST). Also calculate the total cost
 of MST.



- b Explain the naive string-matching algorithm. For text T = "ABABABC" and [08]
 pattern P = "ABC", show all character comparisons clearly.
