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**K. J. Somaiya Institute of Technology, Sion, Mumbai-22**  
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2024		
(B. Tech / M. Tech.) Program: Artificial Intelligence and Data Science Scheme <del>III/IIB/IIIT</del>		
<del>KEF</del> /Supplementary Examination: SY Semester: III		
Course Code: AIC303 and Course Name: Data Structure		
Date of Exam: 21/11/2023	Duration: 02.5 Hours	Max. Marks: 60

**Instructions:**

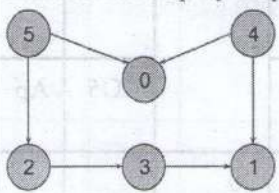
- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any two questions out of three: (05 marks each)	10		
a)	Simulate the operations of a circular queue. Perform the following operations on an empty queue: enqueue (5), enqueue (10), dequeue (), enqueue (15), enqueue (20), enqueue (25). Show the state of the circular queue after each operation.		CO2	Ap
b)	Construct a binary tree from the following: Inorder: H D I B E A F C G Postorder: H I D E B F G C A Provide preorder traversal of the constructed tree.		CO3	Ap
c)	What is an Abstract Data Type (ADT)? Discuss the various types of ADTs with relevant examples.		CO1	U
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Explain how a stack is used to check the well-formedness of parentheses in an arithmetic expression. Write the step-by-step process for verifying if the following expression is well-formed: $((A + B) * (C - D)) / (E + F)$		CO2	Ap
b)	Insert given keys into a binary search tree (BST) in the given sequence: 50, 30, 70, 20, 40, 60, 80. Construct the resulting BST and perform a traversal in the "Right-Root-Left" order. Provide your observations.		CO4	Ap
c)	Explain the concept of hashing. Hash the elements [23, 45, 16, 56, 89] into a table of size 7 using linear probing.		CO5	Ap
Q.3	Solve any two questions out of three: (10 marks each)	20		
a)	Illustrate the steps to balance an AVL tree for the following sequence of insertions:		CO4	Ap



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	10, 20, 30, 25, 15, 5. For each insertion, clearly show: (i) The tree structure after the insertion. (ii) The balance factors of the nodes. (iii) The rebalancing steps (if required), including the type of rotation performed.			
b)	Write an algorithm to implement a Queue using an array. The algorithm should support the following operations: Enqueue(), Dequeue(), Peek(), IsEmpty(), IsFull()		CO2	U
c)	Write an algorithm to implement Depth-First Search (DFS), for the graph represented as an adjacency list, Simulate the DFS starting at node A using the appropriate data structure. A: [B, C] B: [A, D, E] C: [A, F] D: [B] E: [B, F] F: [C, E].		CO3	Ap
Q.4	Solve any two questions out of three: (10 marks each)	20		
a)	Write an algorithm to find and check whether the given word "RADAR" is a palindrome using a queue.		CO6	U
b)	Write an algorithm to perform linear search for a target element in a given array. Perform a linear search to find the element 8 in the array: [10, 22, 8, 35, 44]. How many comparisons are made?		CO5	Ap
c)	Explain the concept of Topological Sorting in directed acyclic graphs (DAGs). Using the given graph with 6 vertices $ V =6$ and $ E =6$ edges, demonstrate step-by-step how to perform a topological sort. 		CO3	Ap

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