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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## June 2025 Semester End Main Examinations

**Programme: B.E.** **Semester: III**

**Branch: Information Science and Engineering** **Duration: 3 hrs.**

**Course Code: 23IS3PCDSC/22IS3PCDSC** **Max Marks: 100**

**Course: Data Structures**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.



**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|
| 1 | a) | Compare Static Memory Allocation and Dynamic Memory Allocation with examples. | CO1 | PO1 | 6 |
| | b) | Design a function to insert an element into a sorted singly linked list. | CO2 | PO2 | 6 |
| | c) | Design a function for the evaluation of a given polynomial using singly linked list along the functions for inserting and reading polynomials. [Consider two variables in the polynomial] | CO3 | PO3 | 8 |
| | | **OR** | | | |
| 2 | a) | Design a function to insert an element after a given element in a singly linked list. | CO2 | PO2 | 6 |
| | b) | Design a function to delete a given element in a given singly linked list. | CO3 | PO2 | 6 |
| | c) | Design a function to add two polynomials using singly linked list. [Assume one variable in the polynomial. Also, no need of functions for creation and display of polynomials] | CO3 | PO3 | 8 |
| | | **UNIT - II** | | | |
| 3 | a) | Design the following functions using doubly linked list.<br>(i) To insert an element at the end<br>(ii) To display the elements in the reverse order | CO2 | PO2 | 6 |
| | b) | Design PUSH, POP and DISPLAY functions to implement stack using singly linked list. | CO2 | PO2 | 6 |
| | c) | Design an algorithm to evaluate a given postfix expression. Also, evaluate the following postfix expression using this algorithm.<br>**3 5 + 4 6 * +** | CO3 | PO3 | 8 |

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| | | | **OR** | | | |
| | 4 | a) | Design the following functions using circular singly linked list.<br>(i) To insert an element at the beginning<br>(ii) To delete an element at the end | *CO2* | *PO2* | **6** |
| | | b) | Design PUSH, POP and DISPLAY functions to implement stack using arrays. | *CO2* | *PO2* | **4** |
| | | c) | Design an algorithm to convert an infix expression to an equivalent postfix expression. Also, convert the following infix expression to postfix expression using this algorithm.<br>**( 2 + 8 * ( 3 - 6 ) )** | *CO3* | *PO3* | **10** |
| | | | **UNIT - III** | | | |
| | 5 | a) | Compare iteration and recursion with examples. | *CO1* | *PO1* | **4** |
| | | b) | Write recursive C functions for the following with an example.<br>(i) GCD of two numbers<br>(ii) To find the $n^{th}$ Fibonacci number | *CO2* | *PO2* | **8** |
| | | c) | Write C functions to perform insertion, deletion and display elements of a circular queue. | *CO2* | *PO2* | **8** |
| | | | **OR** | | | |
| | 6 | a) | Write recursive C functions and sketch the tracings for the following:<br>**(i)** Tower of Hanoi for **n=2**<br>(ii) To find the factorial for **n=4** | *CO2* | *PO2* | **8** |
| | | b) | Write C functions for inserting, deleting and displaying elements in a Linear Queue. | *CO2* | *PO2* | **6** |
| | | c) | Elucidate the concept of double ended queue. | *CO1* | *PO1* | **6** |
| | | | **UNIT - IV** | | | |
| | 7 | a) | Construct a Binary Search Tree for the following numbers inserted in sequence. Also write a C function to create a BST.<br>**23 12 68 56 20 02 29 08** | *CO2* | *PO2* | **8** |
| | | b) | Design the following functions.<br>(i) To find the height of a tree<br>(ii) To find the minimum element in a BST | *CO2* | *PO2* | **6** |
| | | c) | Illustrate the inorder threaded binary trees with an example. | *CO1* | *PO1* | **6** |
| | | | **OR** | | | |
| | 8 | a) | Elucidate the 3 cases to be considered for deletion of an element in a Binary Search Tree. Write suitable examples for each case. | *CO3* | *PO3* | **8** |

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| | | b) | Design the following functions.<br>(i) To count the number of nodes with exactly one child<br>(ii) To find the maximum element in a BST | *CO2* | *PO2* | **6** |
| | | c) | Construct a binary tree when the following traversals are given.<br>(i) Preorder: G I B A H C D N M E<br>Inorder: B A I H G N D M C E<br>(ii) Inorder: F A I E B D C H G<br>Postorder: I A F E C H G D B | *CO3* | *PO3* | **6** |
| | | | **UNIT - V** | | | |
| | 9 | a) | Construct an AVL tree for the following sequence of elements.<br>**1, 2, 3, 4, 5, 6, 7, 8, 9** | *CO3* | *PO3* | **8** |
| | | b) | Write the properties of Red Black trees. | *CO1* | *PO1* | **6** |
| | | c) | Construct a splay tree for the sequence of elements.<br>**15, 10, 17, 7, 13, 16** | *CO3* | *PO3* | **6** |
| | | | **OR** | | | |
| | 10 | a) | Design a function to insert an element into an AVL tree. | *CO2* | *PO2* | **10** |
| | | b) | Construct a Red Black tree for the following sequence of elements.<br>**2, 1, 4, 5, 9, 3, 6, 7** | *CO3* | *PO3* | **6** |
| | | c) | Describe the concept of splaying in a Splay tree with an example. | *CO1* | *PO1* | **4** |

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