

### ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM Single Major B.Sc Computer Science (w.e.f:2023-24A.B)

# III Semester Course 6: Data Structures using C

Credits -3

#### **Course Objectives**

To introduce the fundamental concept of data structures and to emphasize the importance of various data structures in developing and implementing efficient algorithms.

#### **Course Outcomes**

Upon successful completion of the course, a student will be able to:

- 1. Understand various Data Structures for data storage and processing.
- 2. Realize Linked List Data Structure for various operations
- 3. Analyze step by step and develop algorithms to solve real world problems by implementing Stacks, Queues data structures.
- 4. Understand and implement various searching & sorting techniques.
- 5. Understand the Non-Linear Data Structures such as Binary Trees and Graphs

#### UNIT-I

**Basic Concepts:** Pointers and dynamic memory allocation, Algorithm-Definition and characteristics, Algorithm Analysis-Space Complexity, Time Complexity, Asymptotic Notation **Introduction to Data structures:** Definition, Types of Data structure, Abstract Data Types (ADT), Difference between Abstract Data Types, Data Types, and Data Structures.

**Arrays**-Concept of Arrays, Single dimensional array, Two dimensional array, Operations on arrays with Algorithms (searching, traversing, inserting, deleting)

#### UNIT-II

**Linked List:** Concept of Linked Lists, Representation of linked lists in Memory, Comparison between Linked List and Array, Types of Linked Lists - Singly Linked list, Doubly Linked list, Circularly Singly Linked list, Circularly Doubly Linked list;

**Implementation of Linked List ADT:** Creating a List, Traversing a linked list, Searching linkedlist, Insertion and deletion into linked list (At first Node, Specified Position, Last node), Application of linked lists

#### UNIT-III

**Stacks**: Introduction to stack ADT, Representation of stacks with array and Linked List, Implementation of stacks, Application of stacks - Polish Notations - Converting Infix to Post Fix Notation - Evaluation of Post Fix Notation - Tower of Hanoi, Recursion: Concept and Comparison between recursion and Iteration

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**Queues**: Introduction to Queue ADT, Representation of Queues with array and Linked List, Implementation of Queues, Application of Queues Types of Queues- Circular Queues, De-queues, Priority Queue

#### **UNIT-IV**

Searching: Linear or Sequential Search, Binary Search and Indexed Sequential Search

Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort

#### **UNIT-V**

**Binary Trees:** Concept of Non- Linear Data Structures, Introduction Binary Trees, Types of Trees, Basic Definition of Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Operations on a Binary Search Tree, Binary Tree Traversal, Applications of Binary Tree. **Graphs:** Introduction to Graphs, Terms Associated with Graphs, Sequential Representation of Graphs, Linked Representation of Graphs, Traversal of Graphs (DFS, BFS), Application of Graphs.

#### **Text Books:**

- 1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
- 2. A.K. Sharma ,Data Structure Using C, Pearson Education India.
- 3. "Data Structures Using C" Balagurusamy E. TMH

#### **Reference Books**

- 1. "Data Structures through C", Yashavant Kanetkar, BPB Publications
- 2. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.
- 3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata Mcgraw-hill Education (India)Pvt. Ltd.
- 4. Michael T. Goodrich, Roberto Tamassia, David M. Mount "Data Structures and Algorithms in C++", Wiley India.

#### SUGGESTED CO-CURRICULAR ACTIVITIES & EVALUATION METHODS:

**Unit 1: Activity:** Algorithm analysis exercises

**Evaluation Method:** Programming Assignment and Correctness

Unit 2: Activity: Presentations on real-life applications of linked lists

**Evaluation Method:** Presentation skills or reports

**Unit 3: Activity:** Role-playing activities for stack operations

**Evaluation Method:** Problem-solving skills, communication and collaboration abilities.



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Unit 4: Activity: Sorting algorithm analysis and comparison activities

**Evaluation Method:** Performance analysis and presentation.

Unit 5: Activity: Case Study on Applications of Graphs

Evaluation Method: Critical thinking, problem-solving, and presentation skills



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Credits -1

#### **List of Experiments:**

- 1. Write a program to read 'N' numbers of elements into an array and also perform the following operation on an array
  - a. Add an element at the beginning of an array
  - b. Insert an element at given index of array
  - c. Update an element using a values and index
  - d. Delete an existing element
- 2. Write Program to implement Single Linked List with insertion, deletion and traversal operations
- 3. Write Program to implement Circular doubly Linked List with insertion, deletion and traversal operations
- 4. Write Programs to implement the Stack operations using an array
- 5. Write a program using stacks to convert a given infix expression to postfix
- 6. Write Programs to implement the Stack operations using Liked List.
- 7. Write Programs to implement the Queue operations using an array.
- 8. Write Programs to implement the Queue operations using Liked List.
- 9. Write a program for Binary Search Tree Traversals
- 10. Write a program to search an item in a given list using the following Searching Algorithms
  - a. Linear Search
  - b. Binary Search.
- 11. Write a program for implementation of the following Sorting Algorithms
  - a. Bubble Sort
  - b. Insertion Sort
  - c. Quick Sort