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| **Data Structures using C**  |

**Subject Code : 18CSI301 Total Contact Hours: 45**

**Credits : 03 L-T-P: 3-0-0**

**Prerequisite:** Knowledge on Basic Programming using C and Problem Solving Skills.

**Course Objectives:**

* Explain fundamentals of data structures and their applications essential for programming/problem solving
* Analyze Linear Data Structures: Stack, Queues, Lists
* Analyze Non-Linear Data Structures: Trees, Graphs
* Analyze and Evaluate the sorting & searching algorithms
* Assess appropriate data structure during program development/Problem Solving

**Unit I: (9 Hours)**

**Introduction**: Data Structures, Classifications (Primitive &Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. **Pointers and Dynamic Memory Allocation Functions:** Representation of Linear Arrays in Memory, Dynamically allocated arrays, Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. **Sorting and Searching**: Insertion Sort, Radix sort, Address Calculation C Programming Examples Sort.

**Unit II: (10 hours)**

**Stacks and Queues** Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, **Stack Applications**: Polish notation, Infix to postfix conversion, evaluation of postfix expression, **Recursion** - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. **Queues**: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. C Programming.

**Unit III:**

**(10 hours)**

**Linked Lists**: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. **Hashing**: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. C Programming.

**Unit IV: (8 hours)**

**Trees**: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, **Binary Tree Traversals** - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, **Application of Trees**-Evaluation of Expression, C Programming.

**Unit V: (8 hours)**

**Graphs**: Definitions, Terminologies, Types of Graphs, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations. Minimal Spanning Tree: Prim’s algorithm, Kruskal’s Algorithm.**Traversal methods**: Breadth First Search and Depth First Search. Applications of Graph. **Files and Their Organization**: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing.

**Course Outcomes**:

At the end of the course, students will be able to:

* Acquire knowledge of

- Various types of data structures, operations and algorithms.

- Sorting and searching operations.

- File structures.

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* Analyze the performance of – Stack, Queue, Lists, Trees, Graphs, Searching and Sorting techniques.
* Implement all the applications of Data structures in a high-level language.

Design and apply appropriate data structures for solving computing problems

**Text Books:**

1. Weiss, Data Structures and Algorithm Analysis in C, IV Edition, Pearson Education, 2014
2. Lipschutz: Schaum’s outline series Data structures Tata McGraw-Hill

**Reference Books:**

1. Kamthane: Introduction to Data Structures in C. Pearson Education 2005.
2. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006
3. Langsam, AusensteinMaoshe& M.Tanenbaum Aaron Data Structures using C and C++ Pearson Education.
4. Robert Kruse Data Structures and program designing using ‘C’, Trembley and Sorenson Data Structures