**UCSE301: Data Structures and Algorithms Credit: 8**

**Total Contact Hours: 60 L-T-P: 3-1-0**

**Module 1: Contact hours: 14**

Introduction: Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Abstract Data Types (ADT).

Performance of algorithms: space and time complexity measures, asymptotic, worst case and average case analyses, lower and upper bounds. Operations on data;

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations.

Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List- Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

**Module 2: Contact hours: 10**

Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion

Queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.

**Module 3: Contact hours: 6**

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm. Application of trees;

**Module 4: Contact hours: 10**

Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transistive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm, Introduction to Activity Networks

**Module 5: Contact hours: 12**

Searching: Sequential search, Binary Search, Comparison and Analysis

Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting.

Search Trees: Binary Search Trees (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees

**Module 6: Contact hours: 8**

Hashing: Hash Function, Collision Resolution Strategies

Storage Management: Garbage Collection and Compaction.

File Structures: Sequential and Direct Access, Relative files, Indexed files, B+ tree as index, Multi-index files, Hashed files.

**Books/References:**

1. Data Structures and Algorithms, A. V. Aho, J. E. Hoppcroft, J. E. Ullman,

 Addision Wesley.

1. Fundamentals of Data Structures, E. Horowitzz, S. Sahni, Galgotia Publ.
2. Data Structures using C, A.S. Tanenbbaum
3. Algorithms, Data Structures, and Problem Solving, Addision Wesley.
4. Data Mangement and File Structures, Loomis, Marry, PHI
5. Data Structures & Algorithm Analysis in C++, M. A. Weiss, Addision Wesley.
6. Theory and Problems of Data Structures, Lipshutz, McGraw Hill.
7. Learning with C++, Neil Graham, MacGraw Hill