DATA STRUCTURES AND ALGORITHMS SYLLABUS

Module 1: Algorithm Analysis

- Importance of algorithms and data structures
- Fundamentals of algorithm analysis
  - Space and time complexity
  - Asymptotic notations and orders of growth
  - Algorithm efficiency: Best case, worst case, average case
  - Analysis of non-recursive and recursive algorithms
  - Asymptotic analysis for recurrence relations
    - Iteration Method
    - Substitution Method
    - Master Method
    - Recursive Tree Method

Module 2: Linear Data Structures

- Arrays: 1D and 2D
- Stack
  - Applications: Expression Evaluation, Conversion of Infix to Postfix and Prefix, Tower of Hanoi
- Queue
  - Types: Circular Queue, Double Ended Queue (deQueue)
  - Applications
- List
  - Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists
  - Applications: Polynomial Manipulation

Module 3: Searching and Sorting

- Searching
  - Linear Search, Binary Search
  - Applications
- Sorting
  - Insertion Sort, Selection Sort, Bubble Sort, Counting Sort, Quick Sort, Merge Sort
  - Analysis of sorting algorithms

Module 4: Trees

- Binary Tree
  - Definition and Properties
  - Tree Traversals
  - Expression Trees
- Binary Search Trees (BST)
  - Operations: Insertion, Deletion, Finding Min and Max, Finding the kth Minimum Element

Module 5: Graphs

- Terminology
- Representation of Graphs
- Graph Traversal
  - Breadth First Search (BFS)
  - Depth First Search (DFS)
- Minimum Spanning Tree
  - Prim's Algorithm
  - Kruskal's Algorithm
- Single Source Shortest Path
  - Dijkstra's Algorithm

Module 6: Hashing

- Hash Functions
- Separate Chaining
- Open Hashing
    - Linear Probing
    - Quadratic Probing
    - Double Hashing
- Closed Hashing
    - Random Probing
    - Rehashing
    - Extendible Hashing

Module 7: Heaps and AVL Trees

- Heaps
    - Heap Sort
    - Applications
    - Priority Queue using Heaps
- AVL Trees
    - Terminology
    - Basic Operations: Rotation, Insertion, Deletion