

## **Course Content: VI SEMESTER Advanced Algorithmic and Problem Solving**

### **ARRAYS AND STRING:**

Introduction and Time & Space Complexity-Asymptotic Notations-Analysis of Algorithm Efficiency-Arrays: Basic operations on arrays, Problems on Prefix and Suffix, sliding window, 2 pointers, Kadane's algorithm, Arrays and Digit Manipulation-String Algorithms-Advanced string searching algorithms- Bit Manipulation.

### **LINKED LIST, STACK, RECURSION AND BACKTRACKING:**

Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Applications-Stack: Representation, Basic operations, Implementation, Applications.

**Recursion and backtracking:** Analysis of Backtracking Algorithm, Types, Problems on n-Queens, subset sum problem, Hamiltonian Cycle-State-Space Tree-Applications.

### **SORTING AND SEARCHING:**

**Searching:** Problems related to Linear Search, Binary Search, Problems using Binary Search

**Sorting:** Types, Selection Sort, Bubble Sort, Insertion Sort, Heap Sort, Quick Sort, Merge Sort, Time Complexity.

**Hashing** Universal hashing, optimization problems based on searching and sorting.

**Queues:** Representation- Basic Operations, Applications, Deque, priority queue.

### **TREE AND GRAPHS:**

**Binary Tree:** Implementation, Properties, Types, Operations- Binary Search Tree-Segment Trees: Lazy Propagation-Binary Indexed Tree-Binomial Heap-Operations on binomial heaps-Fibonacci Heap-Fibonacci heap operations-Disjoint set union data structures and its operations

**Graphs:** Basic terminologies and representation, DFS, BFS, Topological sort, problems based on Shortest path algorithms, Minimum spanning tree, Articulation points and bridges, Applications of graph.

### **ALGORITHM TECHNIQUES:**

**Dynamic programming:** Basics, Hill climbing- Problems based on Dynamic Programming- Strassen's Matrix multiplication, shortest uncommon subsequence,

**Greedy Technique:** Activity selection problem, task scheduling problem

**Divide and Conquer:** Counting Inversions, Closest pair of points, maximum subarray problem-Hiring problem, randomised algorithms-Maths Algorithms-Game Theory-Trie-Geometric Algorithms.