**Course Content**

01Week 1: Analysis of Algorithm, Mathematics, Bit Manipulation & Arrays

**Class 1:  Analysis of Algorithm, Mathematics & Bit Manipulation**

* Asymptotic Analysis
* Time and Space Complexity
* Masters Theorem
* Bitwise Operators (Bitwise AND, Bitwise OR, Bitwise XOR, Left Shift, Right Shift, etc )
* **Problems:**GCD and LCM, Iterative Power, Generate Power Set, etc

**Class 2:  Arrays**

* Arrays - Introduction and Advantages
* Types of Arrays
* Operations of Arrays - Searching, Insertion, and Deletion
* Sliding Window Technique
* **Problems**: Largest Element in an Array, Leaders in an Array Problem, Maximum Subarray Sum, etc

02Week 2: Recursion, Backtracking & Searching

**Class 1: Recursion and Backtracking**

* Introduction to Recursion
* Writing Base Cases in Recursion
* Tail Recursion
* Introduction to Backtracking
* **Problems:**Print 1 to N Using Recursion, Rope Cutting Problem, Rat in a Maze, etc

**Class 2: Searching**

* Linear Search
* Binary Search - Iterative and Recursive Approach
* Analysis of Binary Search
* Two Pointer Approach
* **Problems:**Index of the first Occurrence in SortedArray, Count 1s in a Sorted Binary Array, Square root of a number, etc

03Week 3: Sorting, Matrix & Hashing

**Class 1: Sorting**

* Overview of the Sorting Algorithm
* Sorting Algorithms e.g. Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort with Analysis
* Stability of Sorting Algorithms
* **Problems:**Minimum Difference in an Array, Chocolate Distribution Problem, etc

**Class 2: Matrix and Hashing**

* Multidimensional Array
* Passing 2D Arrays as an argument
* Hashing Introduction, applications, and analysis
* Collision Handling
* Hashing Function
* **Problems:**Transpose of a Matrix, Matrix in Snake Pattern, Count Distinct Elements, Frequencies of Array Elements, etc

04Week 4: Strings and Linked List

**Class 1: Strings**

* String Introduction
* Overview of Pattern Searching Algorithm
* Naive and Improved Naive Pattern Searching
* Rabin Karp Algorithm
* KMP Algorithm (Constructing LPS Array and Complete Algorithms)
* **Problems:**Palindrome Check, Reverse words in a string, Anagram Search, etc

**Class 2: Linked List**

* Introduction to Linked List
* Traversing a Linked List
* Insertion and Deletion of Node in Linked List
* Doubly Linked List and Circular Linked List
* **Problems:**Middle of Linked List, Deleting a Node without accessing Head pointer of Linked List, etc

05Week 5: Stack, Queue & Deque

**Class 1: Stack**

* Stack - Introduction and Applications
* Stack Operations (e.g. push, pop, etc)
* Array Implementation of Stack
* Linked List Implementation of Stack
* **Problems:**Balanced Parenthesis, Next Greater Element, etc

**Class 2: Queue and Deque**

* Queue - Introduction and Application
* Implementation of Queue using Array
* Implementation of Queue using Linked List
* Deque - Introduction and Application
* **Problems:**Generate Numbers with Gven Dgits, First Circular Tour, etc

06Week 6: Tree and Binary Search Tree

**Class 1: Tree**

* Tree - Introduction and Application
* Introduction to Binary Tree
* Tree Traversal - Inorder, Preorder, and Postorder with Implementation
* Level Order Traversal
* Lowest Common Ancestor of a Binary Tree
* Serialize and Deserialize a Binary Tree
* **Problems:**Height of a Binary Tree, Diameter of a Binary Tree, etc

**Class 2: Binary Search Tree**

* BST - Introduction and Application
* Search in BST with Implementation
* Insert in BST with Implementation
* Deletion in BST with Implementation
* Self Balancing BST - AVL Tree, Red Black Tree
* **Problems:** Find Kth Smallest in BST, Vertical Sum in Binary Tree, Floor in BST, etc

07Week 7: Greedy, Heap and Graph

**Class 1: Greedy and Heap**

* Introduction to Greedy Algorithm
* Binary Heap - Introduction
* Binary Heap - Insertion, Heapify, and Extract
* Binary Heap - Decrease, Delete and Build Heap
* Heap Sort
* Priority Queue
* **Problems:**Activity Selection Problem, Job Sequencing Problem, Sort K Sorted Arrays, etc

**Class 2: Graph**

* Introduction to Graph
* Graph Representation(Adjacency List and Matrix)
* Adjacency Matrix and List Comparison
* Breadth First Search - Introduction and Implementation
* Depth First Search - Introduction and Implementation
* Prims Algorithm - Introduction and Implementation
* Dijkstra Algorithm - Introduction and Implementation
* **Problems:**Bridges in Graph, Detect Cycle in a Directed Graph, etc

08Week 8: Graph(Advanced) and Dynamic Programming

**Class 1: Graph (Advanced)**

* Kruskal's Algorithm
* Bellman-Ford Algorithm
* Ford-Fulkerson Algorithm
* **Problems:**Strongly Connected Components, Find the No. of Islands, etc

**Class 2: Dynamic Programming**

* Introduction to Dynamic Programming
* Dynamic Programming Approach vs Greedy Approach
* How to approach a DP Problem
* Memoization and Tabulation methods
* **Problems:**Coin Change Problem, Longest Common Subsequence, Subset Sum Problem, etc