



Course: Data Structure

Fee: Rs.12500

Duration: 3 month

Syllabus:-

Data Structures Course Syllabus

Module 1: Introduction to Data Structures & Algorithms (DSA)

- What are **Data Structures & Algorithms**?
 - Importance of **Time & Space Complexity**
 - **Big O Notation** & Performance Analysis
 - Recursion & Backtracking Basics
 - Understanding **Iterative vs. Recursive Solutions**
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Module 2: Arrays & Strings

- **Static & Dynamic Arrays**
 - One-Dimensional & Multi-Dimensional Arrays
 - **Searching Algorithms:** Linear Search, Binary Search
 - **Sorting Algorithms:** Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort
 - **Two-Pointer & Sliding Window Techniques**
 - String Manipulation & Pattern Matching (KMP Algorithm, Rabin-Karp)
 - Applications: **Anagram Detection, Palindrome Check, Substring Problems**
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Module 3: Linked Lists

- **Singly Linked List (SLL)**
 - **Doubly Linked List (DLL)**
 - **Circular Linked List (CLL)**
 - **Reversal & Merging of Linked Lists**
 - **Floyd's Cycle Detection Algorithm**
 - Applications: **LRU Cache Implementation, Fast Memory Allocation**
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□ **Module 4: Stacks & Queues**

- **Stack Operations (LIFO) & Implementation (Array & Linked List)**
 - **Queue Operations (FIFO) & Implementation**
 - **Deque (Double-Ended Queue)**
 - **Priority Queue & Min/Max Heap**
 - **Applications: Balanced Parentheses, Undo/Redo Operations, Browser Back/Forward**
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□ **Module 5: Trees & Binary Search Trees (BST)**

- **Tree Terminologies: Root, Node, Height, Depth, Leaf, Sibling, Parent**
 - **Binary Trees & Traversals (Preorder, Inorder, Postorder, Level Order)**
 - **Binary Search Tree (BST) Operations: Insertion, Deletion, Searching**
 - **AVL Trees (Self-Balancing BSTs)**
 - **Segment Trees & Fenwick Trees (BITs)**
 - **Applications: Expression Evaluation, Decision Trees, Huffman Coding**
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● **Module 6: Graphs & Graph Algorithms**

- **Graph Representations: Adjacency List & Adjacency Matrix**
 - **Graph Traversals: BFS & DFS**
 - **Topological Sorting (Kahn's Algorithm, DFS Approach)**
 - **Shortest Path Algorithms: Dijkstra's Algorithm, Bellman-Ford Algorithm**
 - **Minimum Spanning Tree (MST): Kruskal's & Prim's Algorithm**
 - **Cycle Detection in Graphs (Directed & Undirected)**
 - **Applications: Google Maps, Social Network Connections, Web Crawlers**
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□ **Module 7: Hashing & Hash Tables**

- **Understanding Hash Functions**
 - **Collision Handling Techniques (Chaining, Open Addressing)**
 - **Bloom Filters & Hashing in Cryptography**
 - **Applications: Database Indexing, Password Hashing, Caching Mechanisms**
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● **Module 8: Dynamic Programming (DP)**

- **Memoization vs. Tabulation**
- **Fibonacci Series (Top-Down & Bottom-Up Approach)**
- **0/1 Knapsack Problem, Longest Common Subsequence (LCS)**
- **Longest Increasing Subsequence (LIS), Matrix Chain Multiplication**
- **Applications: Stock Market Prediction, Game Theory, Text Editors**

□ **Module 9: Advanced Data Structures**

- **Trie (Prefix Trees) & Auto-Complete Feature**
- **Suffix Arrays & Suffix Trees**
- **Disjoint Set Union (DSU) / Union-Find Algorithm**
- **K-D Trees for Spatial Data Structures**
- **Red-Black Trees & B-Trees**
- **Applications: File Systems, Database Indexing, DNA Sequencing**

Contact Us:

B.O: A-1/17 Second Floor
Janakpuri Delhi 110058
Near Metro pillar No.636
Akash Book Palace
9210767600,9990008195
info@smartfuturepoint.com
<https://www.smartfuturepoint.com>

B.O: R-20 First Floor, Budh
Vihar Delhi 110086, Main
Market Road Near Ramleela
Ground
9210767600,9990008195
info@smartfuturepoint.com
<https://www.smartfuturepoint.com>

