

Data Structures and Algorithms

Course Title: Data Structures and Algorithms

Course No: BIT201

Nature of the Course: Theory + Lab

Semester: III

Full Marks: 60 + 20 + 20

Pass Marks: 24 + 8 + 8

Credit Hrs: 3

Course Description:

The course familiarizes students with different concepts of data structures, abstract types, and algorithms.

Course Objective:

This course aims to provide sufficient theoretical and practical knowledge of data structure and algorithms required to build efficient programs.

Course Contents:

Unit 1: Background and Concept of Data Structures (2 Hrs.)

- Introduction: Data Types, Data Structure, Abstract Data Type
- Background for Data Structure: Array, Array as an ADT, Structure, Pointer, Class in C++

Unit 2: Algorithms (2 Hrs.)

- Fundamentals of Algorithm
- Elementary Analysis of algorithm with asymptotic notations and their properties, time and space complexities

Unit 3: Stack (4 Hrs.)

- Definition
- Primitive Operations, Stack as an ADT
- Stack Applications: Evaluation of Infix, Postfix and Prefix expressions, converting from infix to postfix

Unit 3: Queue (3 Hrs.)

- Definition
- Primitive Operations, Queue as an ADT
- Circular and Priority Queues

Unit 4: Recursion (2 Hrs.)

- Definition and Principle
- Application of recursion with TOH problem, Factorial, Fibonacci Sequences

Unit 5: List (9 Hrs.)

- Definition, Static and Dynamic List Structure
- Operations on Linked List
- Linked implementation of a stack
- Linked implementation of a queue
- Circular Linked List
- Doubly Linked List
- Doubly Circular Linked List

Unit 6: Tree (7 Hrs.)

- Definition and basic terminologies
- Binary Tree: Introduction, Types of Binary Tree, Operations
- Binary Search Tree: Insertion, Deletion, Searching
- Tree Traversal: Pre-order traversal, In-order traversal, Post-order traversal
- Applications of Binary Tree

Unit 7: Sorting (6 Hrs.)

- Introduction and types of sorting
- Algorithm and implementation of Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort
- Comparison and Efficiency of sorting algorithms

Unit 8: Searching (5 Hrs.)

- Introduction
- Sequential Search, Binary Search and Tree Search
- Comparison and Efficiency of Searching
- Hashing

Unit 9: Graph (5 Hrs.)

- Definition, Representation of Graph, Types of Graph
- Graph Traversal: Depth First Search, Breadth First Search
- Spanning Tree, Prim's Algorithm, Kruskal's algorithm and Round Robin Algorithm
- Shortest Path Algorithm, Greedy and Dijkstra's Algorithm

Laboratory works:

Data Structure and Algorithm is highly practical oriented course. Each unit should include plenty of programming practices. Laboratory work should include implementation of Stack, Queue, Lists, Tree, Graphs, and Recursive functions as well as implementation of Sorting Algorithms and Searching Algorithms.

Text Book:

1. Data structure using C and C++, Langsam, Augenstein, Tenenbaum

References Books:

1. Horowitz and Sahni, Fundamentals of Data Structures
2. Aho, Hopcroft and Ullman, Data Structure and Algorithms