### **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.)

- $\circ$  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.)

- $\circ$  Definition
- o 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
- o Operations on Linked List
- Linked implementation of a stack
- Linked implementation of a queue
- o Circular Linked List
- o 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
- o 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
- o Comparison and Efficiency of sorting algorithms

# Unit 8: Searching (5 Hrs.)

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

# Unit 9: Graph (5 Hrs.)

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