

**BCSC0006: DATA STRUCTURES AND ALGORITHMS**

**COURSE OBJECTIVE**

The objective of this course is that students will construct and application of various data structures and abstract data types including lists, stacks, queues, trees and graphs

**CREDITS: 4**

**L-T-P-J:3-1-0-0**

| Module No. | Content   | Teaching Hours |
|------------|---|----------------|
| I          | <p><b>Introduction:</b> Basic Terminology, Elementary Data Organization, Properties of an Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic Notations – Big-Oh; Operations on Data Structure, Abstract Data Types (ADT).</p> <p><b>Linked Lists:</b> Implementation of Singly Linked Lists, Doubly Linked List, Circular Linked List, Operations on a Linked List - Insertion, Deletion, Traversal; Generalized Linked List, Polynomial Representation and Addition.</p> <p><b>Stacks:</b> Primitive Stack Operations - Push &amp; Pop, Array and Linked Implementation of Stack, Application of Stack: Prefix and Postfix Expressions, Evaluation of Postfix Expression, conversion of Infix to Postfix expression</p> <p><b>Recursion:</b> Principles of Recursion, Tail Recursion, Removal of Recursion, use of stack in Recursion, Tower of Hanoi Problem.</p> <p><b>Queues:</b> Operations on Queue - Add, Delete operations, Implementation of Queue Using Array and Linked List, Circular Queues, Deque and Priority Queue.</p> | 20 hours       |
| II         | <p><b>Trees:</b> Basic Terminology, Array Representation and Dynamic Representation; Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Tree Traversal Algorithms - Inorder, Preorder and Postorder; Threaded Binary Trees, Traversing Threaded Binary Trees.</p> <p><b>Search Trees:</b> Binary Search Trees (BST), Insertion and Deletion in BST, AVL Trees, Introduction to M-Way Search Trees, B Trees.</p> <p><b>Searching:</b> Sequential Search, Binary Search.</p> <p><b>Sorting:</b> Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Two Way Merge Sort, and Heap Sort.</p> <p><b>Graphs:</b> Terminology, Adjacency Matrices, Adjacency List, Graph Traversal - Depth First Search and Breadth First Search; Spanning Trees, Minimum Cost Spanning Trees – Prim's and Kruskal's Algorithm; Shortest Path Algorithm – Bellman-Ford and Dijkstra's Algorithm.</p> <p><b>Hashing &amp; Indexing:</b> Hash Function, Collision Resolution Strategies. Primary Indices, Secondary Indices, Indexing and Hashing Comparisons.</p>   | 20 hours       |

**Text Book:**

- Robert Lafore (2003), "Data Structures And Algorithms in Java", 2nd Edition, Pearson SAMS.

**Reference Book:**

- Elliot B. Koffman, Paul A. T. Wolfgang (2016), "Data Structures: Abstraction and Design Using Java", 3rd Edition, Wiley.
- Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser (2014), "Data Structures and Algorithms in Java", 6th Edition, Wiley.
- Horowitz and Sahani (2004-05), "Fundamentals of Data Structures", 3rd Edition, W H Freeman & Co.