

## BCSC0006: DATA STRUCTURES AND ALGORITHMS

**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: 04**

**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 in C, Application of Stack: Prefix and Postfix Expressions, Evaluation of Postfix Expression, conversion of Infix to Postfix expression, Recursion, Principles of Recursion, Tail Recursion, Removal of Recursion, use of stack in Recursion, Tower of Hanoi Problem.</p>	13
II	<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> <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>	14
III	<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>	13

**Text Book:**

- Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein (2009), "Data Structures Using C and C++", 2nd Edition, PHI.

**Reference Books:**

- Horowitz and Sahani (2004-05), "Fundamentals of Data Structures", 3rd Edition, W H Freeman & Co.
- Jean Paul Trembley and Paul G. Sorenson (2007), "An Introduction to Data Structures with Applications", 2nd Edition, TMH.
- R. Kruse, "Data Structures and Program Design in C" (2004), 2nd Edition, Pearson Education.
- Lipschutz Schaum's Outline Series (2010), "Data Structures", 12th Reprint, TMH.
- G A V Pai (2009), "Data Structures and Algorithms", TMH.

**Outcome:** After completion of course, student will be able to:

- Understand the concept of Dynamic memory management, data types, different data structure and asymptotic notations.
- Student will be able to choose appropriate data structure as applied to specified problem.
- Able to compare, implement and know when to apply sorting algorithm including bubble sort, selection sort, heap sort.