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| **CS3501** | **Data Structure** | **L-T-P: 3-0-0; Total 42 Lectures** |

**Pre-requisites:** None

**Objectives:**

* To understand the different data structures.
* To learn which data structure should be used to make the algorithm simpler, easier to maintain, and faster.
* To improve the proficiency of students in applying the basic knowledge of programming to solve different problems.

**Course Outcomes:**

At the end of the course, a student should have:

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| **Sl. No.** | **Outcome** |
|  | Understanding the fundamentals of data structures. |
|  | Learning the set of operations that can be performed on the given data structure. |
|  | To improve the proficiency of programmers by enhancing their skill of choosing the right data structure for a problem. |
|  | To understand which searching and sorting technique best suits in the given scenario. |

**Unit 1: Introduction:** Characteristics of data structures, Creating, manipulating and operating on data structures, Types of data structures – linear and nonlinear. Introduction to algorithms: Asymptotic notations, Analysis of algorithms: Time complexity and Space complexity.**10 Lectures**

**Unit 2: Arrays:** 1-D arrays, multi-dimensional arrays, operating on arrays, Dynamic memory allocation, Storage – Column major order and Row major order, Address calculation of 1-D, 2-D, different form of matrix, Sparse Matrix. Linked lists – singly, doubly and circularly linked lists, operations on linked lists. **8 Lectures**

**Unit 3: Stacks:** Basics of Stack data structure, Implementation of stack using array and linked list, Operations on stacks, Applications of Stacks, Notations – infix, prefix and postfix, Conversion and evaluation of arithmetic expressions using Stacks. **5 Lectures**

**Unit 4: Queues:** Basics of Queue data structure, Implementation of queue using array and linked list, Operations on queues, Types of queues – queue, double ended queue, priority queue and Implementation of these. **3 Lectures**

**Unit 5: Trees & Graph:** Binary tree, Binary search tree, Threaded binary tree, AVL Tree, B Tree, Tries, Heaps, Hash tables. Graph and its implementation, Graph traversals: Breadth First Search, Depth First Search, Spanning Tree – Prim’s algorithm and Kruskal’s algorithm, Shortest path- Dijkstra's algorithm and Bellman Ford algorithm. Union-find data structure and applications, Topological sorting for Directed Acyclic Graph. **8 Lectures**

**Unit 6: Searching and Sorting:** Linear search, Binary search, Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Bucket sort. **8 Lectures**

**Text Books:**

1. Fundamentals of Data Structures by E. Horowitz, S. Sahni, Computer Science Press, 2ndEdition, 2008
2. Data Structure and Program Design by R. L Kruse, Prentice Hall, 2nd Edition, 1996