Course Name : **Data structures and Algorithms**

Course Type: Core   Course Credits: (3+1 credits)

Objectives:

The objective of this course is to understand the basic concepts of data structures and algorithms, and perform various operations on different data structures, and compute time and space complexity of various algorithms.

Learning Outcomes

After Successful completion of the course, the students should be:

- Understand the basic concepts of algorithm analysis and data structures.
- Articulate linear data structures and operations performed on them.
- Articulate Non-linear data structures and operations performed on them.
- Implement appropriate searching and sorting algorithms.
- Understand various problem-solving paradigms.

Unit I: Introduction to Data Structures and Algorithms

Introduction to Algorithms, Analysis of algorithms, Designing Algorithms, Growth of Functions, Asymptotic notations, Time and Space Complexity study of some basic algorithms. Abstract data types (ADTs), Introduction to Data Structures, Types of Data Structures:-Linear and Non-Linear Data Structures.

Unit II: Linear Data Structure

Array-based data structures: arrays and matrices, Memory Representation, Searching and Sorting. Strings: string manipulation, pattern matching algorithms. Linked lists: Introduction, Types:-singly linked lists, doubly linked lists, and circular linked lists. Stacks: Introduction, List and Array representations, operations on Stack (push, pop, traversal), Polish notation: Evaluation and their Conversions, Queues: Concept, implementation, operations, and applications.

Unit III: Non Linear Data Structure

Trees: - Binary Trees: Introduction, Representation and Traversal, Binary Search Tree: Introduction, Insertion, search and deletion operations, AVL trees: Introduction, Insertion and Deletion and Search operations, B-trees. Heap, binary heap, and heap operations. Graphs: Basic Terminologies, representation, graph traversals (DFS, BFS).

Unit IV: Advanced Data Structures and Algorithms

Hashing: hash functions, collision resolution techniques. Advanced sorting algorithms: quicksort, merge sort, heap sort. Advanced Algorithm Paradigms. Divide and Conquer Algorithm, Dynamic Programming, Greedy Algorithms, Backtracking

   Recommended Books

1. Fundamentals of data structures – Ellis Horowitz and Sartaj Sahni
2. Data Structures Files and Algorithms – Abhay K. Abhyankar
3. Data Structures and Algorithms – Alfred V. Aho, John E. Hopcroft,Jeffrey D. Ullman (Pearson Education)
4. Data Structures –Seymour Lipschutz

Course Name : **Lab on Data structures and Algorithms**

1. Write a program to perform following operations on an array: a) Insertion, b) Deletion, c) Traversal
2. Write a program to search an element in an array using Linear Search
3. Write a program to search an element in an array using Binary Search
4. Write a program to sort elements of array using Bubble sort.
5. Write a program to sort elements of array using Selection sort.
6. Write a program to sort elements of array using Insertion sort.
7. Write a program to implement matrix operations using multidimensional array.
8. Write a program to perform string manipulation operations.
9. Write a program to perform the following operations on Singly Linked list: a) Creation, b) Insertion, c) Deletion, d) Traversal.
10. Write a program to perform the following operations on Doubly Linked list: a) Creation, b) Insertion, c) Deletion, d)Traversal.
11. Write a program to perform the following operations on Circular Linked list: a) Creation, b) Insertion, c) Deletion, d) Traversal.
12. Write a program to Implement Stack using array to perform the following operations: a) Push, b) Pop, c) Traversal
13. Write a program to Implement Stack using Linked List to perform the following operations: a) Push, b) Pop, c) Traversal
14. Write a program that uses stack operations to convert a given infix expression into its postfix equivalent.
15. Write a program to Implement Queue using array to perform the following operations: a) Insertion, b) Deletion, c) Traversal
16. Write a program to Implement Queue using Linked List to perform the following operations: a) Insertion, b) Deletion, c) Traversal
17. Write a program to perform the following operations on binary Search tree: a) Insertion, b) Deletion, c) Traversal
18. Write a Program to implement the tree traversal methods.
19. Write a program to search for a key element in a Binary Search tree.
20. Write a program to perform the following operations on AVL tree: a) Insertion, b) Deletion, c) Traversal.
21. Write a program to search for a key element in an AVL tree.
22. Write a program to sort the list of elements using Quick sort.
23. Write a program to sort the list of elements using Merge sort.
24. Write a program to sort the list of elements using Heap sort.

Write a program to perform BFS and DFS traversal on Graphs