CA20109A **(3L + 1 T hrs./week)**

DATA STRUCTURE AND ALGORITHMS

No. of questions to be set: Total 5 questions will be given from Unit I & Unit II.
No. of questions to be answered: All questions to be answered.

Objective: This course intends to provide students the knowledge of linear data structures such as linked lists, stacks, queues, and non-linear data structures such as trees, and graphs. This course also explores the close relationship between data structures and algorithms. It focuses on different algorithm analysis techniques, design strategies and their applications

Pre-requisites: Programming concepts and 'C' language.

Course Outcomes (CO):

CO1	Students will be able to assess how the choice of data structures and algorithm design methods impacts the performance of programs
CO2	Students will be able to select the appropriate data structure for a specified application
CO3	After completion of the course students can select an appropriate algorithmic design technique for their solution.

UNIT I

Introduction and Overview of Data Structures [2 Hrs.]
Definitions, Concept of Data Structure, Overview of Data Structure

Linear data structure [10 hrs.]
Arrays, Multidimensional arrays, Operations on arrays, Singly linked list, Doubly linked list, Circular linked list, Operations on a Single Linked List, Stacks, Operations on Stacks, Queues, Operations of Queues

Non-Linear Data Structures [10 hrs.]
Tree definition, Binary Trees, Representing Binary Trees, Traversing Binary tree, Binary Search Tree, Infix, Prefix, Postfix notations, Heaps, Operations on a Heap, Graph definition, Basic Terminologies, Adjacency Matrix Representation and Adjacency List Representation of Graphs, Graph Traversals: BFS and DFS

UNIT II

Introduction to Algorithms [4 Hrs]

Order of growth and Asymptotic notation, Analysis of insertion sort, Worst case and average case analysis, Divide-and-Conquer approach, Analysis of merge sort. A recurrence relation with its analysis.

Binary Search Trees and Dynamic Programming [8 hrs.]

Insertion, deletion and Optimal binary search trees, Dynamic Programming approach, Matrix chain multiplication, Counting the number of parenthesization, Recursive solution, Computing the optimal cost.

Greedy Algorithm and NP Completeness [8 hrs.]

Greedy vs dynamic programming. Huffman codes: Prefix codes. Knapsack problem. Basic Concepts on N and NP Completeness. Cook's theorem statement.

TextBooks:

1. Horowitz & Sahni, Fundamentals of Data Structures, Galgotia.
2. Coreman, Liesorson, Rivest, Design and Analysis of Algorithms, PHI.

Reference Books:

1. Seymour Lipschutz, Data Structures, Schaum Series
2. Aaron M.Tanenbaum, Data Structures using C and C++, PHI
3. D. Samanta, Classic Data Structures, PHI
4. Horowitz and Sahini, Fundamental of Computer Algorithms, Galgotia.
5. Hopcroft and Ullman, Design and Analysis of Algorithms, Wesley.