

Course Code CSD3009	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS	Course Type	LTP
		Credits	4
Course Objectives: <ul style="list-style-type: none"><li>To understand the basic concepts of data structures and algorithms.</li><li>To differentiate linear and non-linear data structures and the operations upon them.</li><li>Ability to perform sorting and searching in a given set of data items.</li><li>To comprehend the necessity of time complexity in algorithms.</li></ul>			
Course Outcomes: <ul style="list-style-type: none"><li>Understanding the fundamental analysis and time complexity for a given problem.</li><li>Articulate linear data structures and legal operations permitted on them.</li><li>Articulate non-linear data structures and legal operations permitted on them.</li><li>Applying a suitable algorithm for searching and sorting.</li><li>Understanding graph algorithms, operations, and applications.</li><li>Understanding the importance of hashing</li></ul>			
Student Outcomes (SO): a, b, c, l <ul style="list-style-type: none"><li>a. Having an ability to apply mathematics and science in engineering applications.</li><li>b. Having design thinking capability.</li><li>c. Having an ability to design a component or a product applying all the relevant standards and with realistic constraints.</li><li>d. Having problem solving ability- solving social issues and engineering problems.</li></ul>			
Module No.	Module Description	No.of Hours	SO
1	Introduction: Overview of Data Structures – A Philosophy of Data Structures – The Need for Data Structures – Cost and Benefits – Abstract Data Types - complexity analysis – Best, Worst, and Average Cases – Asymptotic Analysis - Arrays, Linked Lists and Recursion: Using Arrays – Lists – Array based List Implementation – Linked Lists – LL ADT – Singly Linked List – Doubly Linked List – Circular Linked List – recursion- linear, binary, and multiple recursions.	7+2	a, b, c
2	Stacks and Queues: Array- 1D and 2D array, Stack - Applications of stack: Expression Evaluation - Conversion of Infix to postfix and prefix expression, Tower of Hanoi. Stack ADT – Array based Stacks, Linked Stacks – Implementing Recursion using Stacks, Queues – ADT, Array based Queue, Linked Queue, Double ended queue, Circular queue.	7+2	a, b, c

<b>3</b>	<b>Trees and Graphs:</b> Trees: Binary tree, Binary search tree, threaded binary tree, Height balanced trees, Tries, Heaps, Hash tables. Graph traversals: Breadth-First Search, Depth First Search, Shortest path: Depth-first search in directed and undirected graphs. Union-find data structure and applications. Directed acyclic graphs; topological sort.	<b>7+2</b>	<b>a, b, f</b>
<b>4</b>	<b>Searching and Sorting:</b> Searching: Linear search, Binary search and Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Radix sort, Bucket sort. Algorithm design techniques: Divide and conquer, Greedy approach, dynamic programming.	<b>6+2</b>	<b>a, b, f</b>
<b>5</b>	<b>Graph Traversal:</b> Breadth First Search (BFS), Depth First Search (DFS) - Minimum Spanning Tree: Prim's, Kruskal's- Single Source Shortest Path: Dijkstra's Algorithm.	<b>6+2</b>	<b>a, b, c</b>
<b>5</b>	<b>Guest Lecture on Contemporary Topics</b>	<b>2</b>	
	<b>Total Hours:</b>	<b>45</b>	

**Mode of Teaching and Learning:**

Teaching and Learning will be from a variety of books and articles, and will be made available on-line through Blackboard. Also through CALTech.

**Mode of Evaluation and assessment:**

The course grade will be based on homework assignments, a final group presentation, a final group paper, peer evaluation for group work, attendance, and class participation. Homework Assignments, Final Presentation, Final Paper, Attendance and Class Participation, Peer Evaluation etc

**Text Book(s):**

1. Data Structures and Algorithm Analysis in C++ Mark Allen Weiss Florida International University, 2015.
2. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2010.

**References:**

1. Data Structures, Algorithms, and Applications in C++ Book by Sartaj Sahni 2005.
2. Goodrich M. T., Tamassia R. and Michael H. Goldwasser, "Data Structures and Algorithms in Python++", Wiley publication, 2013
3. Clifford A. Shaffer, "Data Structures and Algorithm Analysis", Third Edition, Dover Publications, 2012.

### Indicative List of Experiments

No.	Description of Experiment	SO
1	Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	I
2	Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	I
3	Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal.	I

4	Sorting algorithm – insertion, bubble, selection, quick	I
5	Write a program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a key element in a binary search tree.	I
6	DFS, BFS	I
7	Minimum Spanning Tree – Prim's and Kruskal's	I

<i>Recommendation by the Board of Studies on</i>	
<i>Approval by Academic council on</i>	
<i>Compiled by</i>	<b>Dr.R.Rakesh</b>