Course Code CSD3009	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS	Course Type	LTP
		Credits	4

Course Objectives:

- To understand the basic concepts of data structures and algorithms.
- To differentiate linear and non-linear data structures and the operations upon them.
- Ability to perform sorting and searching in a given set of data items.
- To comprehend the necessity of time complexity in algorithms.

Course Outcomes:

- Understanding the fundamental analysis and time complexity for a given problem.
- Articulate linear data structures and legal operations permitted on them.
- Articulate non-linear data structures and legal operations permitted on them.
- Applying a suitable algorithm for searching and sorting.
- Understanding graph algorithms, operations, and applications.
- Understanding the importance of hashing

Student Outcomes (SO): a, b, c, l

a. Having an ability to apply mathematics and science in engineering applications.
b. Having design thinking capability.
c. Having an ability to design a component or a product applying all the relevant standards and with realistic constraints.
d. Having problem solving ability- solving social issues and engineering problems.

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

3	**Trees and Graphs**: 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.	**7+2**	**a, b, f**
4	**Searching and Sorting**: 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.	**6+ 2**	**a, b, f**
5	**Graph Traversal:** Breadth First Search (BFS), Depth First Search (DFS) - Minimum Spanning Tree: Prim's, Kruskal's- Single Source Shortest Path: Dijkstra's Algorithm.	**6+2**	**a, b, c**
5	**Guest Lecture on Contemporary Topics**	**2**	
	Total Hours:	**45**	

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.	**l**
2	Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	**l**
3	Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal.	**l**
4	Sorting algorithm – insertion, bubble, selection, quick	**l**
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.	**l**
6	DFS, BFS	**l**
7	Minimum Spanning Tree – Prim's and Kruskal's	**l**

Recommendation by the Board of Studies on	
Approval by Academic council on	
Compiled by	**Dr.R.Rakesh**