DATA STRUCTURES

III Semester: CSE / IT / ECE / ME / CE | IV Semester: AE / EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB03	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The course covers some of the general-purpose data structures and algorithms, and software development. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. The main objective of the course is to teach the students how toselect and design data structures and algorithms that are appropriate for problems that they might encounter in real life. This course reaches to student by power point presentations, lecture notes, andlab which involve the problem solving in mathematical and engineering areas.

II. OBJECTIVES:

The students will try to learn:

I The skills needed to understand and analyze performance trade-offs of different algorithms implementations and asymptotic analysis of their running time and memory usage.

II The knowledge of basic abstract data types (ADT) and associated algorithms:stacks, queues, lists, tree, graphs, hashing and sorting, selection and searching.

III The fundamentals of Non-linear Data structure to store, retrieve, and process dataefficiently.

IV The implementing these data structures and algorithms and Understand essentialfor future programming and software engineering courses.

V Analyze and choose appropriate data structure to solve problems in real world.

III. COURSE OUTOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** the complexity of algorithm using the asymptoticnotations.	Understand
CO 2	**Select** appropriate searching and sorting technique for a givenproblem.	Apply
CO 3	**Construct** programs on performing operations on linear and nonlinear data structures for organization of a data	Apply
CO 4	**Make use of** linear data structures and nonlinear data structures solving real time applications.	Apply
CO 5	**Describe** hashing techniques and collision resolution methodsfor efficiently accessing data with respect to performance.	Understand
CO 6	**Compare** various types of data structures ; in terms ofimplementation, operations and performance.	Analyze

IV. SYLLABUS:

MODULE – I	INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING	Classes: 09

Basic concepts: Introduction to data structures, classification of data structures, operations on data structures; Algorithm Specification, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega, and Theta notations. Introduction to Linear and Non Linear data structures, Searching techniques: Linear and Binary search; Sorting techniques: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort and comparison of sorting algorithms.

MODULE - II	LINEAR DATA STRUCTURES	Classes: 09

Stacks: Stack ADT, definition and operations, Implementations of stacks using array, applications of stacks, Arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue and double ended queue (deque).

MODULE - III	LINKED LISTS	Classes: 09
Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation. Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue.		
MODULE - IV	**NON LINEAR DATA STRUCTURES**	**Classes: 09**
Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, threaded binary trees, application of trees, Graphs: Basic concept, graph terminology, Graph Representations - Adjacency matrix, Adjacency lists, graph implementation, Graph traversals – BFS, DFS, Application of graphs, Minimum spanning trees – Prims and Kruskal algorithms.		
MODULE - V	**BINARY TREES AND HASHING**	**Classes: 09**
Binary search trees: Binary search trees, properties and operations; Balanced search trees: AVL trees; Introduction to M-Way search trees, B trees; Hashing and collision: Introduction, hash tables, hash functions, collisions, applications of hashing.		

Text Books:

1. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.

Reference Books:

1. S. Lipschutz, "Data Structures", Tata McGraw Hill Education, 1st Edition, 2008.
2. D. Samanta, "Classic Data Structures", PHI Learning, 2nd Edition, 2004.

Web References:

1. https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm
2. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
3. https://www.cs.auckland.ac.nz/software/AlgAnim/ds_ToC.html
4. https://online-learning.harvard.edu/course/data-structures-and-algorithms