DATA STRUCTURES

II Semester: **CSE/IT/ECE/EEE**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACS002	Foundation	3	1	3	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic techniques of algorithm analysis.
II. Demonstrate searching and sorting algorithms and analyze their time complexities.
III. Implement linear data structures viz. stack, queue and linked list.
IV. Demonstrate non-linear data structures viz. tree and graph traversal algorithms.
V. Study and choose appropriate data structure to solve problems in real world.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand algorithms and data structures in terms of time and space complexity of basic operations.
2. Analyze a given problem; choose an appropriate data structure and an algorithm to solve the problem.
3. Choose a suitable algorithm to organize the data in ascending or descending order.
4. Understand the difference between iterative and recursion approaches to solve problems.
5. Explore an algorithm to find the location of an element in a given list.
6. Understand the usage of divide and conquer strategy in searching and sorting applications.
7. Compare the time complexities of various searching and sorting algorithms.
8. Understand the working principle of linear data structures and their real time applications.
9. Organize the data in various linked representation format.
10. Design and implement abstract data types for linear and non-linear data structures.
11. Describe the concept of non-linear data structures viz. trees and graphs and their applications.
12. Compare and Contrast the operations of binary search trees and AVL trees.
13. Understand the concept of M-way search trees, operations and applications.
14. List out different tree and graph traversal techniques.
15. Understand the implementation of hashing using hash table and hash function.
16. Describe the concept of collision and its resolving methods in applications.
17. Strengthen the knowledge of data structures and algorithms for employability.

Unit-I	INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING	Classes: 11

Basic concepts: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms; Searching techniques: Linear search, binary search and Fibonacci search; Sorting techniques: Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.

Unit -II	LINEAR DATA STRUCTURES	Classes: 09

Stacks: Primitive operations, implementation of stacks using Arrays, 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).

Unit -III	LINKED LISTS	Classes: 10

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.

Unit -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, application of trees; Graphs: Basic concept, graph terminology, graph implementation, graph traversals, Application of graphs, Priority Queue.

Unit -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.
3. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
4. Martin Jones, "Python for Complete Beginners", 2015.
5. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.
6. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.