Program	Bachelor of Technology (BTech)	**Semester - 3**
Type of Course	Professional Core	
Prerequisite	Basic Programming	
Course Objective	To learn the basic types of Data Structures, their implementation, and their applications. To understand the importance of using suitable data structures for efficient programming. To develop the skill to identify appropriate data structures in problem-solving.	

Teaching Scheme (Contact Hours)				Examination Scheme				
Lecture	Tutorial	Practical	Credit	Theory Marks		Practical Marks		Total Marks
				SEE (T)	CIA (T)	SEE (P)	CIA (P)	
3	0	4	5	40	30	20	10	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Data Structure & Linear Data Structures: Array and Stack** **Data Structure:** Data Management concepts, Data Types (Primitive & Non-primitive), Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Order Notations, Types of Data Structures (Linear & Non Linear Data Structures) **Array:** Representation of Arrays, Sparse Matrix and its representation, Applications of Array **Stack:** Definitions & Concepts, Operations on Stack, Applications of Stack: Polish Expression and their compilation, Polish Notations, Conversion of Infix Expression to Polish Notations, Evaluation of Polish Expressions, Recursion	9	20
2	**Linear Data Structures : Queue and Linked List** **Queue:** Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue **Linked List:** Singly, Doubly & Circular Linked List - Representation and Operations	8	20
3	**Nonlinear Data Structures : Tree and Graph** **Tree:** Definitions and Concepts, Representation of Binary Tree, Conversion of General Tree to Binary Tree, Binary Tree Traversal (Preorder, Inorder & Postorder), Threaded Binary Tree, Binary Search Tree (BST), Balanced Trees: Height Balanced Tree (AVL Tree, 2-3 Tree), Weight Balanced Tree, Multiway Search Tree (B-Tree, B+ Tree), Applications of Tree **Graph** - Matrix Representation of Graph, Graph Traversals : Breadth First Search (BFS) & Depth First Search (DFS), Spanning Trees, Minimum Spanning Tree, Prim's Algorithm, Kruskal's Algorithm, Finding the Shortest Path, Dijkstra's Algorithm	12	20
4	**Hashing and File Structures** **Hashing:** The symbol table, Hashing Functions, Collision-Resolution Techniques **File Structure:** Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods	8	20
5	**Sorting and Searching** **Sorting:** Bubble Sort, Selection Sort, Insertion Sort, Bucket Sort, Radix Sort, Shell Sort, Counting Sort, Merge Sort, Quick Sort, Heap Sort, Sorting on multiple keys, Sorting without comparison **Searching:** Linear Search, Binary Search	8	20
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	15	35	40	0	0	0

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	**understand** the importance of data structure for efficient programming.
CO2	**analyze** the linear data structures and their applications.
CO3	**implement** the non-linear data structures and perform different operations on them.
CO4	**describe** the hashing functions and file structures.
CO5	**differentiate** the working of searching and sorting techniques.

Reference Books

1.	**An Introduction to Data Structures with Applications** By Jean-Paul Tremblay & Paul G. Sorenson | Tata McGraw Hill
2.	**Data Structures using C & C++** By Aaron M. Tanenbaum | PHI Learning
3.	**Fundamentals of Computer Algorithms** By Ellis Horowitz, Sartaj Sahni, Sanguthever Rajasekaran | Universities Press (India) Private Limited | 2001
4.	**Fundamentals of Data Structures in C++** By Sartaj Sahani
5.	**Data and File Structures using C** By Reema Thareja | Oxford University Press

List of Practical

1.	Hands-on practice to get familiar with basic programming concepts
2.	Hands-on practice to get familiar with advanced programming concepts
3.	Regular operations on 1-D Array Data Structure
4.	Advanced operations on 1-D Array Data Structure
5.	Operations on 2-D Array Data Structure
6.	Implementation of OOP concepts Class and Object
7.	Implementation of Data Structure Stack
8.	Implementation of Applications of Stack
9.	Implementation of Data Structure Queue
10.	Implementation of Data Structure Singly Linked List
11.	Implementation of Stack & Queue Data Structure using Linked List
12.	Advanced operations on Singly Linked List Data Structure
13.	Implementation of Data Structure Circular and Doubly Linked List
14.	Implementation of Non-Linear Data Structure Binary Search Tree (BST)
15.	Operations on Non-Linear Data Structure Binary Search Tree (BST)
16.	Implementation of Non-Linear Data Structure Graph
17.	Implementation of Data Structure Hash Table
18.	Implementation of different Searching techniques (Linear Search & Binary Search)
19.	Implementation of Bubble Sort & Insertion Sort
20.	Implementation of Selection Sort & Radix Sort
21.	Implementation of Quick Sort & Heap Sort