

**Subject Code: 01CE0301**

**Subject Name: Data Structure**

**B.Tech. Year - II**

**Objective:** Data structure has high importance in the field of Computer & IT. Organization of data is crucial for implementation and for that it requires efficient algorithms. Understanding of data structures and their related applications are highly needed to build sustainable program.

**Credits Earned:** 5 Credits

**Course Outcomes:** End of this course will help to understand following aspects.

- Can recognize the need of data structures
- Can analyse various data structures and their applications.
- Able to design and implement various techniques for searching and sorting.
- Identification of appropriate data structures for the requested requirement for a given application.

**Pre-requisite of course:** Computer Programming in C

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	0	2	5	50	30	20	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b>Introduction to Data Structures:</b> Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures, Linear & non-linear Data Structures	6

2	<p><b>Linear Data Structures &amp; their representation:</b> Representation of arrays, sparse matrix and its representation, Storage Structures for arrays, Applications of arrays.</p> <p>Stack definitions &amp; concepts, operations on stacks ( push, pop, peep, change) Applications like: Recursion</p> <ul style="list-style-type: none"> <li>• Polish Expressions and their compilation</li> <li>• Tower of Hanoi</li> </ul> <p>Representation of queue, operations on queue ( insert, delete)</p> <ul style="list-style-type: none"> <li>• Simple Queue</li> <li>• Circular Queue</li> <li>• Double Ended Queue</li> <li>• Priority queues</li> <li>• Applications of Queue</li> </ul> <p>Linked list Understanding and their Operations</p> <ul style="list-style-type: none"> <li>• Singly Linked List</li> <li>• Doubly Linked List</li> <li>• Circular Linked List</li> <li>• Circular Doubly Linked</li> <li>• Applications of Linekd List</li> </ul>	16
3	<p><b>Nonlinear Data Structure:</b> Tree definitions and their concepts, Representation of binary tree, Binary tree traversal methods and their examples (Inorder, postorder, preorder), Binary search trees. Method to Convert a general trees to binary tree, Threaded binary tree Applications of Trees. Balanced tree and its mechanism,</p> <ul style="list-style-type: none"> <li>• AVL tree</li> <li>• Weight Balanced Trees</li> <li>• Height Balanced tree</li> <li>• B Tree</li> <li>• B+ Tree.</li> </ul> <p>Graphs and their understanding, Matrix representations of a given graph. Depth First Search (DFS), Breadth First Search (BFS), Minimum Spanning Trees Algorithms (Prims, Kruskal, Dijkstra), Path Matrix, Warshall's Algorithm.</p>	16
4	<p><b>Sorting &amp; Searching techniques :</b> Sorting Concepts and methods</p> <ul style="list-style-type: none"> <li>• Bubble Sort,</li> <li>• Selection Sort</li> <li>• Insertion Sort</li> <li>• Quick Sort</li> <li>• Merge Sort</li> </ul>	8

	Searching Concepts and Methods <ul style="list-style-type: none"> <li>• Sequential Search</li> <li>• Binary Search</li> </ul>	
5	<b>Hashing and Collusion</b> Hashing Concepts and methods Hash Table Methods-Introduction, Hashing Functions. Collusion and its understanding. Discuss different Collision-Resolution Techniques with examples.	8
	<b>Total Hours</b>	<b>54</b>

**References:**

1. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill
2. Tanenbaum, Data Structures using C & C++, PHI
3. Robert L. Kruse, Data Structures and Program Design in C, PHI
4. Mary E.S. Loomis, Data Management and file processing, PHI

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	20%	15%	0%	25%

**Suggested List of Experiments:**

1. Introduction to pointers. Call by Value and Call by reference.
2. Introduction to Dynamic Memory Allocation. DMA functions malloc(), calloc(), free() etc.
3. Implement a program using array for stack that performs operations (a) PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY
4. Implement a program to convert infix notation to postfix notation using stack.
5. Write a program to implement QUEUE using arrays that performs following operations (a) INSERT (b) DELETE (c) DISPLAY

6. Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY
7. Write a menu driven program to implement following operations on the singly linked list.
  - (a) Insert a node at the front of the linked list.
  - (b) Insert a node at the end of the linked list.
  - (c) Insert a node such that linked list is in ascending order.(according to info. Field)
  - (d) Delete a first node of the linked list.
  - (e) Delete a node before specified position.
  - (f) Delete a node after specified position.
8. Write a program to implement stack using linked list.
9. Write a program to implement queue using linked list.
10. Write a program to implement following operations on the doubly linked list.
  - (a) Insert a node at the front of the linked list.
  - (b) Insert a node at the end of the linked list.
  - (c) Delete a last node of the linked list.
  - (d) Delete a node before specified position.
11. Write a program which create binary search tree and traversal methods.
12. Write a program to implement Quick Sort.
13. Write a program to implement Merge Sort.
14. Write a program to implement Bubble Sort.
15. Write a program to implement Linear and Binary Search.

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

**Supplementary Resources:**

- a. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- b. <https://visualgo.net/en>
- c. <https://www.cs.usfca.edu/~galles/visualization/Algorithms.html>
- d. <https://quizlet.com>