

2. C L. Liu, "Elements of Discrete Mathematics", TMH.
3. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI.
4. NarsinghDeo, "Graph Theory With Application to Engineering and Computer Science", PHI.
5. Charles S. Grimmstead, J. Laurie Snell "Introduction to Probability".
- Kai Lai Chung, "A Course in probability theory".
6. J.P.Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science" Mc.Graw Hill.

| Course Code | Type | Subject         | L | T | P | Credits | CA | MS | ES | CA | ES | Pre-requisites |
|-------------|------|-----------------|---|---|---|---------|----|----|----|----|----|----------------|
| CACSC02     | CC   | Data Structures | 3 | 0 | 2 | 4       | 15 | 15 | 40 | 15 | 15 | None           |

### COURSE OUTCOMES

1. Candidate will be able to choose the appropriate data structure for a specified problem and determine the same in different scenarios of real world problems.
2. Become familiar with writing recursive methods and reducing larger problems recursively in smaller problems with applications to practical problems.
3. Be able to understand the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and apply the same to real life problems of sorting, searching, and traversals for skill enhancement in problem solving.
4. Be able to implement various data structures in more than one manner
5. Understand the advantages and disadvantages of the different implementations by using efficient representation of problems.

### COURSE CONTENT

#### UNIT-I

**Introduction:** Basic Terminology: Elementary Data Organization, Data Structure Operations, Algorithms Complexity and Time-Space Trade off.

**Arrays:** Array Definition and Analysis, Representation of Linear Arrays in Memory, Traversing, Insertion And Deletion in Array, Single Dimensional Arrays, Two Dimensional Arrays, Bubble Sorting, Selection Sorting, Linear Search, Binary Search, Multidimensional Arrays, Function Associated with Arrays, Character String in C, Character String Operations, Arrays as parameters, Implementing One Dimensional Array.

#### UNIT-II

**Stacks and Queues:** Introduction to Operations Associated with Stacks Push & Pop, Array representation of stacks, Operation associated with stacks: Create, Add, Delete, Application of stacks recursion polish expression and their compilation conversion of infix expression to prefix and postfix expression, Tower of Hanoi problem, Representation of Queues, Operations of queues: Create, Add, Delete, Front, Empty, Priority Queues and Heaps, Dequeue.

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### UNIT-III

**Recursion:** Recursive thinking, Recursive Definition of Mathematical Formulae, Recursive Array Search, Recursive Data Structure, Problem Solving With Recursion, Back Tracking

**Linked Lists:** More operations on linked list, polynomial addition, Header nodes, doubly linked list, generalized list, circular linked lists.

### UNIT-IV

**Trees:** Trees – mathematical properties, Binary Search Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, Traversing binary trees, Searching, Insertion and Deletion in binary search trees, Complexity of searching algorithm, Path length, Huffman's algorithm, General trees, AVL trees, Threaded trees, B trees, Trie data structure

### UNIT-V

**Sorting:** Insertion Sort, Quick sort, two-way Merge sort, Heap sort, sorting on different keys, External sorting

**Graphs:** Sequential representation of graphs, Adjacency matrices, Search and Traversal of graphs: Depth first, breadth first, topological sort.

#### Outline of Practical Work:

- Programs based on sorting and searching, implementing stacks, queues, simple calculator using postfix expression, command line calculator changing infix to postfix, implementation of linked lists - a simple editor program, traversal of binary trees, binary search tree creation, insertion, deletion, traversal sorting, AVL tree creation and rotations, Traversal of graphs using BFS and DFS, implementation of topological sorting, Templates and Containers Survey of new data structures.

### Suggestive List of Experiments

1. Write a program to find the mean and the median of the numbers stored in an array.
2. Write a program to insert one element in an array and delete an element from an array.
3. Write a program to search for a number in an array.
4. Write a program to sort an array.
5. Write a program to merge two sorted arrays
6. Write a program to store the marks obtained by 10 students in 5 courses in a two-dimensional array.
7. Write a program to implement a linked list.
8. Write a program to insert a node in a linked list and delete a node from a linked list.
9. Write a program to print the elements of a linked list in reverse order without disturbing the linked list.
10. Write a program to reverse a linked list.
11. Write a program to add two polynomials using linked lists.
12. Write a program to implement a doubly-linked list.
13. Write a program to implement a stack using an array
14. Write a program to implement a stack using a linked list.
15. Write a program to implement a queue using an array.
16. Write a program to implement a queue using a linked list.
17. Write a program to implement a circular queue using an array.
18. Write a program to implement a priority queue using a linked list.
19. Write a program to implement a double-ended queue using a linked list.

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20. Write a program to construct a binary tree and display its preorder, inorder and postorder traversals.
21. Write a program to construct a binary search tree.
22. Write a program to construct a graph.
23. Write a program to calculate the distance between two vertices in a graph.
24. Write a program to calculate the distances between every pairs of vertices in a graph.
25. Write a program to construct a minimal spanning tree of a graph.

#### **References and Text Books:**

1. Nell B Dale, "C++ data structures", ISBN-10: 1449646751, 5-th edition.
2. Freetextbooks.com. Algorithms and data structures.  
Available : <http://www.freetechbooks.com/algorithms-and-data-structures-f11.html>
3. Robert Lafore, "Data structures in Java".
4. Data Structures – Horowitz Sahani PHI
5. Data Structures – Lipshutz TMH