

Course Type	Course Code	Name of Course	L	T	P	Credit
ESC1	NCSE101	Fundamentals of Data Structures	3	0	0	3

Course Objective
Understanding towards how the choice of data structures impacts the performance of the program.
Learning Outcomes
Ability for the following. <ul style="list-style-type: none"> <li>Choose the appropriate data structure for a specified application.</li> <li>Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, binary search trees, Minimum Spanning Tree, Single-source shortest path computation, graphs and writing programs for these solutions.</li> </ul>

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	<b>Introduction:</b> Overview of data structures - Linear and Nonlinear, Art of writing algorithms, Time analysis of algorithms - Big Oh and Theta notations	3	Learning types of data structures and getting familiar with notations
2	<b>Preliminaries:</b> Function, Pointer, Call-by-value, Call-by reference, Structure	2	Basic understanding of C-programming
3	<b>Array:</b> Linear array and basic operations, Searching: Linear and Binary search, Memory representation of matrices, Application - System of linear equations.	3	Understanding of arrays, their implementation and applications
4	<b>Linked List:</b> Linear linked list and its basic operations, Double linked list, Application of linked list - Sparse matrix representation and Generalized lists.	3	Understanding of different types of linked lists and their applications
5	<b>Stack:</b> Representation of stack: Array and Linked list, Operations on stack, Applications - Parenthesis matching and Towers of Hanoi.	3	Understanding of stack, its implementation and applications
6	<b>Queue:</b> Representation of queues - Array and Linked list, Circular queue, Priority Queue	3	Learning different types of queues and their uses
7	<b>Sorting and Order Statistics:</b> Minimum and maximum, Insertion sort, Selection sort, Bubble sort, Quick sort, Merge sort, Sorting on several keys, Median selection.	7	Learning of efficient searching solutions and various sorting techniques
8	<b>Tree:</b> Basic terminology, Binary trees and properties, Tree representation, Binary tree traversal, Threaded binary trees, Binary search trees, Expression trees, AVL trees, Red Black trees, Applications - Tournament trees and Huffman coding.	9	Using binary tree and their variations
9	<b>Graph:</b> Basic terminology, Representations of graph, Depth-first search and Breadth-first search, Minimum spanning trees - Kruskal and Prim's algorithms, Dijkstra's algorithm	7	Understanding of graph data structure with related graph algorithms
10	<b>Hash Table:</b> Hashing techniques, Collision resolution techniques, Closed hashing, Open hashing.	2	Learning techniques of hashing

#### Text Books:

1. J. P. Tremblay and P. G. Sorenson, "An Introduction to Data Structures with Application", TMH
2. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures"
3. Seymour Lipschutz, "Data Structures with C (Schaum's Outline Series)"

#### Reference Books:

1. Cormen, Leiserson, Rivest and Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2010.