NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	BTech CSE, Integrated BTech (CSE)-MBA, BTech AI&ML
Course Code:	2CS501CC23
Course Title:	Data Structures
Course Type:	Core
Year of Introduction:	2023-24

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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to –

1. explain various data structures and relate them to appropriate applications (BL2)
2. identify the appropriate data structure to design an efficient algorithm for the given application (BL3)
3. apply various techniques on linear and non-linear data structures for searching and sorting (BL3)
4. choose an appropriate data structure for the solution of a problem. (BL5)

Unit	Contents	Teaching Hours (Total 30)
Unit-I	**Introduction to Data Structures:** Basic Terminology, Elementary Data Structure Organisation, Classification of Data Structures: Primitive and Non-primitive, Linear and Non- linear, Operations on Data structures, Time and Space complexity, Introduction to asymptotic notations	03
Unit-II	**Linear Data Structures:** Introduction, variations, operations and applications of the array, queue, stack and linked list	09
Unit-III	**Non-Linear Data Structures:** Non-Linear Data Structures: Concepts and types of trees, tree traversal algorithms, search trees, Priority queue implementation and applications, Representations of Graphs, Graph algorithms i.e., traversals i.e., DFS and BFS, Disjoint Data Structure for minimum spanning tree, shortest path, Topological sorting	09
Unit-IV	**Indexing structure:** Concepts and implementations of B-Tree, B+ tree, Hashing, Dictionary	04
Unit-V	**Searching and Sorting Algorithms:** Linear search, Binary search, internal and external sorting algorithms, sorting without comparison.	05

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

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

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	a. An organisation has to maintain its employee's details. There is a need to access the details of employees frequently. Taking this information into consideration, use an appropriate data structure to implement a system for providing the functionality of adding details of new employees, removing employee details from the system, and listing all employees' details. b. Design an anagram game using an array. Allow a user to enter N words and store it in an array. Generate a random number between 0 to N-1. Based on the random number generated, display the word stored at that index of an array and allow the user to enter its anagram. Check whether the word entered by the user is an anagram of the displayed number or not and display an appropriate message. [Given a word A and word B, B is said to be an anagram of A if and only if the characters present in B are the same as characters present in A, irrespective of their sequence. For ex: "LISTEN" == "SILENT"]	04
2	a. Write a program to reverse the elements in the stack using recursion. b. Write a program to convert a fully parenthesized infix expression into a postfix expression. Show all the intermediate results in the table format.	04
3	a. Write a program to simulate printer spooler application. Assume a maximum of 5 users are using this printer. Use appropriate data structure to implement the system. b. Write a program to implement a priority queue using a 2D array.	02
4	Write a program to implement a doubly linked list where each node consists of integer values. The program should support the following functionalities. i. Create a doubly linked list ii. Delete a node if it is found otherwise display an appropriate message ii. Search a given integer value in the list v. Display the doubly linked list	02
5	a. Write a program to simulate music player application using suitable data structure. There is no estimation about number of music files to be managed by the music player. Your program should support all the basic music player operations to play and manage the playlist. b. Write a program to perform the addition of two polynomial equations using the appropriate data structure.	04
6	Write a program to construct a binary tree from the given post-order and in-order traversal sequence.	02

7	Write a program to implement a phone book dictionary using Binary Search Tree which provides the following operations: i. Add a new entry in the phone book ii. Remove entry from phone book iii. Search phone number iv. List all entries in ascending order of name v. List all entries in descending order of name.	04
8	Write a program to traverse connected undirected graphs using the Depth First Search (DFS) traversing technique and give the traversing sequence.	02
9	a. Write a program to implement selection sort for sorting a given set of integers in ascending order and calculate time complexity. b. Write a program to implement a quick sort algorithm for sorting a given set of integers in ascending order and calculate time complexity.	04
10	Implement a Binary search technique, which takes a list of unique values sorted in descending order and a value to search for and returns either the index of the value or None if the value isn't in the list.	02