

## NIRMA UNIVERSITY

<b>Institute:</b>	Institute of International Study
<b>Name of Programme:</b>	Bachelor of Science (Computer Science and Engineering) [2+2 Dual Degree]
<b>Faculty</b>	Faculty of Technology & Engineering
<b>Course Code:</b>	<del>1XXXX</del> 2CS501
<b>Course Title:</b>	Data Structures
<b>Course Type:</b>	Core
<b>Year of Introduction:</b>	2023-24

L	T	Practical Component				C
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### Course Learning Outcomes (CLO):

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

- analyze various data structures and their applicability
- utilize various techniques for searching and sorting for real-world problems
- identify the appropriate data structure to design efficient algorithm for the given application
- Compare trade-offs in the design and implementations of the data structures

### Syllabus:

**Total Lecture hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	<b>Introduction to Data Structures:</b> Basic Terminology, Elementary Data Structure Organization, 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	<b>Linear Data Structures:</b> Introduction, variations, operations and applications of array, queue, stack and linked list	09
Unit-III	<b>Non-Linear Data Structures:</b> 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	<b>Indexing structure:</b> Concepts and implementations of B-Tree, B+ tree, Hashing, Dictionary	04
Unit-V	<b>Searching and Sorting Algorithms:</b> 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 semester. Around 10% of the questions will be asked from self-study contents

**Suggested Readings/References:**

- Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill
- 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 List of Experiments:	Sr. No.	Title	Hours
	1	a. An organization has to maintain its employee's details. There is need of accessing details of employees frequently. Taking this information into consideration, use an appropriate data structure to implement system for providing functionality of adding details of new employee, removing employee's detail from the system and listing all employees' details. b. Design anagram game using 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 user to enter its anagram. Check whether the word entered by the user is an anagram of 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 is 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 fully parenthesized infix expression into postfix expression. Show all the intermediate results in the table format.	04
	3	a. Write a program to simulate printer spooler application. Assume maximum 5 users are using this printer. Use appropriate data structure to implement the system. b. Write a program to implement priority queue using 2D array.	02

  
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- 4 Write a program to implement doubly linked list where each node consists of integer values. The program should support following functionalities. 02
- i. Create a doubly linked list
  - ii. Delete a node if it is found, otherwise display an appropriate message
  - iii. Search a given integer value in the list
  - iv. Display the doubly linked list
- 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. 04
- b. Write a program to perform addition of two polynomial equations using appropriate data structure.
- 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 phone book dictionary using Binary Search Tree which provides following operations: 04
- i. Add new entry in 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.
- 8 Write a program to traverse connected undirected graph using 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. 04
- b. Write a program to implement Quick sort algorithm for sorting a given set of integers in ascending order and also calculate time complexity.
- 10 Implement 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

Suggested Case  
List:

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