GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Computer Applications

Level: Under Graduate

Course / Subject Code : BC02001011

Course / Subject Name : Data Structure

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Core Courses

Prerequisite:	Proficiency in a programming language
Rationale:	• To develop proficiency in the specification, representation, and implementation of Data Types and Data Structures. • To introduce the concepts of algorithmic paradigms and basic data structures and their applications. • To analyze various algorithms for space and time complexity. • To implement and compare various searching and sorting techniques. • To apply appropriate data structures to solve different problems.

Course Outcome:

After completion of the course, student will able to:

No	Course Outcomes	RBT Level*
1	Demonstrate familiarity with data structures.	U
2	Implement concepts of linear data structures like array, stack, queue, linked list with their representation and perform different operations on them.	AP
3	Implement concepts of tree & graph with their representation and apply various operations on them.	AP
4	Implement concepts of hashing.	AP
5	Develop programs for Searching and Sorting.	AP

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		**Tutorial / Practical**		
L	**T**	**PR**	**C**	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)

1	INTRODUCTION TO DATA STRUCTURE: Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures-Linear & Non Linear Data Structures.	5	10
2	LINEAR DATA STRUCTURE Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	14	30
3	NONLINEAR DATA STRUCTURE : Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of TreesSome balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	14	30
4	HASHING AND FILE STRUCTURES : Hashing: The symbol table, Hashing Functions, CollisionResolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods.	06	15
5	Sorting & Searching: Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	06	15
	Total Hours:	**45**	

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20%	**30%**	**50%**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

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Level: Under Graduate
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Course / Subject Name : Data Structure

References/Suggested Learning Resources:
(a) Textbook:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.

Reference Books:
1. Data structure in C by Tanenbaum, PHI publication / Pearson publication.
2. Fundamentals of data structure in C, Horowitz, Sahani & Freed, Computer Science Press.
3. Classical Data Structure, D. Samanta, PHI
4. Fundamental of Data Structure, (Schaums Series) Tata-McGraw-Hill.
5. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.
6. Data Structures, schaum's Outlines,Adapted by G A PAI
7. Gilberg and Forouzan: "Data Structure- A Pseudo code approach with C" by Thomson publication

Suggested Course Practical List:

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 for stack that performs following operations using array. (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. 7. Write a program to implement stack using linked list.
8. Write a program to implement queue using linked list.
9. 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.
10. Write a program to implement following operations on the circular linked list. (a) Insert a node at the end of the linked list. (b) Insert a node before specified position. (c) Delete a first node of the linked list. (d) Delete a node after specified position.
11. Write a program which create binary search tree.

12. Implement recursive and non-recursive tree traversing methods inorder, preorder and postorder traversal.
13. Write a program to implement Queue Sort
14. Write a program to implement Merge Sort
15. Write a program to implement Bubble Sort
16. Write a program to implement Binary Search

List of Laboratory/ Active Learning Assignment: If any

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.

CO- PO Mapping:
*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

Semester 2	Subject Name: Data Structure										
	POs										
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	-
CO3	3	3	2	-	1	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-
CO5	3	3	3	-	2	-	-	-	-	-	-

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