Lok Jagruti Kendra University
University with a Difference

Diploma
in
Information Technology

Course Code: 025040401

Data Structures

Programme/ Branch Name	Diploma in Information Technology				
Course Name	Data Structures			**Course Code**	025040401
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends:
HSSC: Humanities and Social Sciences Courses   BSC: Basic Science Courses
ESC: Engineering Science Courses   PCC: Program Core Courses
OEC: Open Elective Courses   PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	4	5	50	50	50	150

Legends:

L: Lectures   T: Tutorial   P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th):   Semester End Evaluation (Theory)
SEE (Pr):   Semester End Evaluation (Practical)
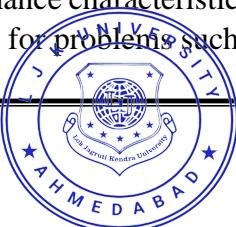
2. Prerequisites

✓ Basic knowledge of Computer.
✓ Basic problem-solving capability.
✓ C programming advanced concepts.
✓ Knowledge of algorithm concepts.

3. Rationale

The objective of the course is to introduce the fundamentals of Data Structures, basic concepts and how these concepts are useful in problem solving. After completion of this course student will be able to analyze any problem step by step and develop algorithms to solve real world problems. Implement various data structures like Stack, Queue, Linked List and Tree. Develop understanding of various searching techniques for information retrieval and sorting techniques for proper arrangement of the purpose of efficient data storage.
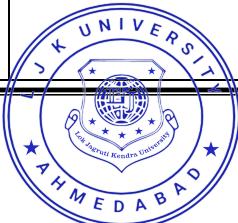
4. Objectives

✓ Be able to check the correctness of algorithms using inductive proofs and loop invariants.

✓ Be able to compare functions using asymptotic analysis and describe the relative merits of worst-case, average-case, and best-case analysis.

✓ Be able to develop algorithms and step by step approach to solve various problems.

✓ Become familiar with a variety of sorting algorithms and their performance characteristics (e.g., running time, stability, space usage) and be able to choose the best one under a variety of requirements.

✓ Be able to understand and identify the performance characteristics of fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching etc.

5. Contents

| Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1	**Introduction to Data Structures**	1.1. Data Structures, Definition, Introduction Application 1.2. Classification of Data Structures 1.3. Algorithm, Definition, Properties, Time Complexity, Space Complexity 1.4. Array, Introduction, Array Operations 1.5. String, Definition, String Operations	• List the types of data structures. • Comprehend the linear and Non-linear data structures. • Analysis of Algorithms. • List the different operations on array and string.	15	8
2	**Stack and Queue**	2.1. Stack, Definition, Operations on Stack, Implementation of Stack 2.2. Applications of Stack Polish Notation, Conversion of Arithmetic Expression,Recursive Functions 2.3. Queue,Definition, Characteristics, Classification of Queue 2.4. Operations on Simple Queue,Implementation of Simple Queue, Limitation of Simple Queue 2.5. Implementation of Circular Queue and Operations on it, 2.6. Advantages and Applications of Queue	• Comprehend linear and nonlinear data structures and develop algorithms to push an element into stack, pop an element from the stack. • Implement the prefix and postfix expression for stack. • Build programs using recursion. • Comprehend Queue with various operations like insert and delete. • The drawback of Simple Queue. • Differentiate Circular and Simple queue.	25	9
3	**Linked List**	3.1. Dynamic Memory Allocation 3.2. Linked list, Definition, Representation 3.3.Operations on Singly Linked List 3.4.Operations on Circular Linked List 3.5.Operations on Doubly Linked List	• Define concept of various linked list and its operations and develop various algorithms on it • State application of linked list	25	10

		3.6.Linked list Implementation 3.7.Applications of Linked List			
4	**Binary Tree**	4.1. Tree, Definition, Terminology 4.2. Binary Tree 4.3. Conversion from General Tree to Binary Tree 4.4. Binary Search Tree 4.5. Operations on Binary Search Tree 4.6. Tree Traversal Algorithms 4.7. Binary Tree Implementation 4.8. Applications of Tree	• Develop algorithms to • Manipulate tree • Implement various tree • Manipulation - algorithms • List applications of tree	20	8
5	**Sorting and Searching Techniques**	5.1. Sorting 5.2. Sorting Algorithms and Implementation 5.3. Searching 5.4. Searching Algorithms and Implementation	• Analyze data sorting, • Differentiate and develop sorting and searching techniques	15	7

	Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practicals / Exercises	Key Competency	Hours
1	Write a program to perform various Array operations.	Functioning of linear DS.	4
2	Write a program to perform String operations.	Implementation & working of character array.	4
3	Write a program to demonstrate use of Structures and Pointers.	Basic knowledge that is needed to study linked-list	4
4	Write a program to implement PUSH and POP algorithms of Stack.	Implementation of concept of LIFO.	4
5	Write a program to implement recursive functions.	Working and applications of Stack.	4
6	Write a program to implement INSERT and DELETE algorithms of Simple Queue.	The concept of FIFO.	4
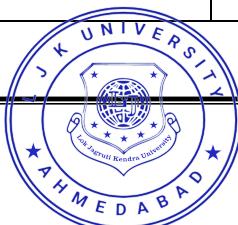
7	Write a program to implement INSERT and DELETE algorithms of Circular Queue.	Implementation of FIFO.	4
8	Write a program to implement various operations on Singly Linked List.	Concept of DMA with one pointer to store address.	4
9	Write a program to implement various operations on Circular Linked List.	Concept of DMA with one pointer.	4
10	Write a program to implement various operations on Doubly Linked List.	Concept of DMA with two pointers to enable 2-way traversal.	4
11	Write a program to implement Binary tree.	Functioning of non-linear data structures.	4
12	Write a program to implement various sorting techniques.	Different methods to sort data.	4
13	Write a program to implement Linear Search algorithm.	Searching technique to search data sequentially.	4
14	Write a program to implement Binary Search algorithm.	Searching technique to search data by dividing the list into two intervals.	4
		Total Hours	**56**

7. Suggested Specification Table for Evaluation Scheme

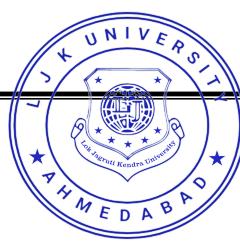| Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1	Introduction to Data Structures	25	40	35	-	-	-
2	Stack and Queue	20	25	30	10	10	5
3	Linked List	25	30	30	10	-	5
4	Binary Tree	30	30	15	10	10	5
5	Sorting and Searching Techniques	25	20	25	10	15	5

Legends: R: Remembering   U: Understanding
App: Applying   C: Creating
E: Evaluating   An: Analyzing

8. Textbooks

1) Data Structures Using C by Reema Thareja, Latest Edition, Oxford University Press.

9. Reference Books

1) Data Structures Using C by Balagurusamy, Latest Edition, Tata McGraw Hill Publication.
2) Data Structures Using C by Aaron M. Tanenbaum, Latest Edition, Pearson Education.

10. Open Sources (Website, Video, Movie)

1) https://nptel.ac.in/courses/106/102/106102064/
2) https://www.coursera.org/specializations/data-structuresalgorithms
3) https://www.tutorialspoint.com/data_structure_online_training/index.asp
4) https://turboc.me/download-turbo-c-file/