Gyanmanjari Innovative University

Subject: Data Structure and Algorithm - MSCIT12506

Type of course: Major Core

Prerequisite: Basic Knowledge of C Language

Rationale:

Data structures play a crucial role in Information and Communication Technology, serving as a fundamental aspect. The organization and structuring of data hold significant importance in the realm of efficient algorithm implementation and program development. To tackle problems effectively, it's imperative to apply the appropriate data structures throughout the development process.

A strong grasp of data structures is indispensable, as it aids in comprehending programming languages. The practice and absorption of data structure techniques are vital for proficient programming. Practical exercises during the course of study will reinforce one's knowledge of the 'C' language and data structures. This course equips students with the ability to choose the most suitable data structure for a given task.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
3	0	4	5	60	30	10	20	30	150

Legends: CI-ClassRoom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

CourseContent:

Sr. No.	Course content	Hrs	% 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, bestand worst-case analysis) • Types of Data Structures- Linear & Non-Linear Data Structures.	4	15%
2	**LINEAR DATA STRUCTURE - ARRAY AND STACK:** • **Array**: Representation of arrays, Types of Arrays (Single dimensional and multi-dimensional), Applications of arrays • **Stack**: Stack-Definitions & Concepts, Operations on Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression and Their Compilation, Applications of Stack	10	20%
3	**LINEAR DATA STRUCTURE - QUEUE AND LINKED LIST:** • **Queue**: Representation Of Queue, Operations on Queue, Circular Queue, 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.	12	25%
4	**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 Trees, Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance • **Graph:** Definitions and Concepts, Elementary Graph operations, Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree	12	25%
5	**SORTING, SEARCHING AND HASHING:** • **Sorting**: Bubble Sort, Selection Sort, Quick Sort, Merge Sort • **Searching**: Sequential Search and Binary Search • **Hashing**: The symbol table, Hashing Functions, Collision Resolution Techniques.	5	15%

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Building Bridges:** Students have to create user manuals or documentation for specific data structures, explaining their usage, methods, and best practices. Also, they have to upload it on GMIU webportal.	10
2	**From Theory to Application:** Students have to analyze real-world datasets and find the most suitable data structures for efficient storage and retrieval. submit the document for 5 datasets analysis on the GMIU webportal.	10
3	**Visualize the Flow:** Students have to create animation for the different Data structures and have to upload on GMIU webportal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	40%	20%	10%	0	0

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course students should be able to:	
CO1	Provide definitions and categorize different types of data structures and storage arrangements, as well as outline typical actions and functions associated with them.
CO2	Create various linear data structures with their representation and perform different operations on them.
CO3	Establish a variety of non-linear data structures, illustrate their representations, and execute a spectrum of operations on them.
CO4	Apply various searching sorting techniques on data set.
CO5	Address a given problem by applying a suitable data structure for optimal performance, and subsequently, evaluate and compare its performance against alternative data structures.

List of Practical

Sr. No.	Description	Unit No.	Approx. Hrs. Req
1.	Write a program to implement pointer and pointer to pointer.	1	2
2.	Write a program to demonstrate use of malloc(), calloc() and free() functions.	1	2
3.	Implement a program for stack that performs following operations using array (a) PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY	2	4
4.	Write a program to implement QUEUE using arrays that performs following operations (a) INSERT (b) DELETE (c) DISPLAY	2	4
5.	Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY	2	4
6.	Write a menu driven program to implement various operations on the singly linked list.	3	4
7.	Write a program to implement stack using linked list.	3	4
8.	Write a program to implement Queue using linked list.	3	4
9.	Write a program to implement various operations on the doubly linked list.	3	4
10.	Write a program which create binary search tree.	4	4
11.	Implement recursive and non-recursive tree traversing methods inorder, preorder and postorder traversal.	4	4
12.	Write a program to implement Bubble Sort	5	2
13.	Write a program to implement Merge Sort	5	4
14.	Write a program to implement Linear Search	5	2
15.	Write a program to implement Binary Search	5	2

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

1) An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill
2) Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.
3) Fundamentals of Data Structures in C++-By Sartaj Sahani. .
4) Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.