Course Syllabus
Gyanmanjari Institute of Technology
Semester-3(B. Tech.)

Subject: Data Structure-BETCE13303

Type of course: Major (Core)

Prerequisite: Basic Knowledge of C/C++/JAVA/Python

Rationale:

Data structures are fundamental components of computer science that organize and store data in a way that enables efficient access and modification. They serve as the building blocks for designing algorithms and solving complex problems. Arrays are a simple data structure that stores elements of the same type in contiguous memory locations, allowing for fast access using indices. Linked lists are dynamic data structures that consist of nodes, each containing a data element and a reference to the next node, enabling efficient insertion and deletion operations. Other common data structures include stacks, queues, trees, graphs, and hash tables, each with its own unique properties and use cases. Understanding these data structures and their associated algorithms is essential for developing efficient and scalable software solutions.

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	
4	0	2	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.

Course Content:

Sr. No	Course content	Hrs.	% Weightage
1	**Basic Concepts of Data Structures** Data Structure Basic Concepts, Types of data structures, Differentiate primitive and non-primitive data structures, Introduction to Algorithms, Key features of an algorithm., Analysis Terms (for the definitions purpose only): a. Time Complexity b. Space Complexity Array: i. Row Major Arrays ii. Column Major Arrays, Overview of different array operations Searching an element into an array: i. Linear Search ii. Binary Search	10	15
2	**Stack and Queues** Linear and Non-Linear Data Structures, Stack : Array representation of Stack, PUSH- POP Operations on Stack, Implementation of Stack, Application of Stack, Infix, Prefix and Postfix Forms of Expressions, Recursive Functions (Factorial, greatest common divisor, Fibonacci series), Queue: Array representation of Queue Operations on a Queue (Add an element, delete an element, display all elements of a queue), Implementation of a Queue, Limitation of a Single Queue, Concepts of Circular Queue ,Applications of a queue, Differentiate circular queue and simple queue.	15	25
3	**Linked List:** Linked list Presentation, Types of Linked List, Basic operations on singly linked list : Insertion of a new node in the beginning of the list, at the end of the list, after a given node, before a given node, in sorted linked list, Deleting the first and last node from a linked list, Searching a node in Linked List, Count the number of nodes in linked list, Concepts of circular linked list ,Difference between circular linked list and singly linked list, Doubly linked list: Representation ,Difference between Doubly linked list and singly linked list . List applications of the linked list, Applications of the linked list.	15	20
4	**Trees:** Non-linear data structures: Tree, Graph, Basic Terms: General Tree, Forest, Binary trees, level number, degree, in-degree and out-degree, root node, leaf node, directed edge, path, depth Binary tree: Complete Binary Tree, Strict Binary Tree, Conversion of General Tree to Binary Tree, Binary Search Tree: Insertion of a node in binary tree, Deletion of a node in binary tree, Searching a node in binary tree Binary Tree Traversal: Inorder, Preorder, Postorder. Applications of binary tree.	10	25

5	**Sorting and Hashing:** Sorting Methods: Bubble Sort, Selection Sort, Quick Sort, Insertion Sort, Merge Sort. Hashing Concepts Hash functions: Division Method, Middle Square Method, Folding Method.	10	15

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Compare Data Structures:** Compare different data structures in terms of their strengths, weaknesses, and performance characteristics. Create charts or tables to summarize your findings and upload it on GMIU Web Portal.	10
2	**SortRace: Quick vs. Merge Showdown:** Participants conduct a speed race between Quick Sort and Merge Sort to sort a large dataset. They analyze and compare the time complexity and efficiency of each sorting method and upload data on GMIU Web Portal.	10
3	**Interactive Visualizations:** Use virtual lab and resources that provide interactive visualizations of data structures. This can help you visualize how data is stored and manipulated within different structures. Upload soft copy on GMIU Web Portal.	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	20%	35%	35%	10%	-	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Learn basic operations on arrays
CO2	Implement different operations like insert and delete with stack and queue data structure.
CO3	Implement different operations of link list.
CO4	Illustrate algorithms to insert, delete and searching a node in tree.
CO5	Apply different sorting and searching algorithms on appropriate data sets.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	Write a program for array using row major order and column major order.	1	2
2	Write a program Implement Sequential search algorithm.	1	2
3	Implement push and pop algorithms of stack using array.	1	4
4	Develop a program to present Recursive Functions (Factorial, greatest common divisor, Fibonacci series)	2	2
5	Implement insert of queue.	2	2
6	Implement Delete and Searching of queue.	3	2
7	Implement insertion of node in the beginning of the list in singly linked list. Implement insertion of node at the end of list in singly linked list.	3	4
8	Implement deletion of node at Start and end position in liked list.	4	4
9	Implement searching of a node algorithm in singly linked list.	4	2
10	Write a program Sorting Methods: Bubble Sort, Selection Sort, Quick Sort, Insertion Sort, Merge Sort.	5	6
		Total	30

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] Data Structures & Algorithms in JAVA, Michael T. GoodRich, Roberto Tamassia, Michael H. Goldwasser , Wiley.

[2] Data Structures and Algorithms in Java, Adam Drozdek, Cengage Learning.

[3] An Introduction to Data Structures with Applications, Jean-Paul Tremblay & Paul G. Sorenson , Tata McGraw Hill

[4] Data Structures, Chitra, A Rajan, Tata McGraw Hill.

[5] Data Structures & Algorithms in Python, Michael T. GoodRich, Roberto Tamassia, Michael H. Goldwasser, Wiley.

[6]Data Structures using C & C++, Tenen Baum,Prenctice-Hall International