Syllabus for First Year M.Sc. (CA&IT)
Semester-II

[Five Years' (Full-time) M.Sc. (CA&IT) Integrated Degree Course]

Offered in

K. S. School of Business Management and Information Technology

Gujarat University

2023–2024

As per

NEP2020 CURRICULUM AND CREDIT FRAMEWORK FOR UNDER GRADUATE PROGRAMMES,UGC

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of

Education Department, Govt. of Gujarat

Semester-II

(B.Sc.(CA&IT)Programme)

MAJOR

Gujarat University

K. S. School of Business Management and Information Technology
[Five Years' (Full – Time) M.Sc. (CA&IT) Integrated Degree Course]
First Year M.Sc. (CA&IT) (Semester - II)

Course Name: Data Structure & Algorithm -Theory

Course Code: DSC-C-IMSCIT-121T

Course Credit: 4

Course Outcomes:

After learning the course, the students should be able:

- Data Structure is a subject of primary importance in information and communication Technology
- Students should be able to comprehend the fundamental data structures such as arrays, linked lists, stacks, queues, and trees.
- Develop problem-solving skills using algorithms and data structures. And Analyze and solve algorithmic problems using concepts learned in the course.
- Understand advanced data structures such as binary trees, AVL trees, heaps, and graphs.
- Implement and analyze algorithms related to tree and graph traversal, shortest path, and minimum spanning trees.
- Apply sorting and searching algorithms to the small and large data sets

Contents:

Unit No.	Course Content	Hours	Credits
1	**INTRODUCTION TO DATASTRUCTURE USING INDIAN KNOWLEDGE SYSTEM:-** Meru Prastaar's Algebra, Narayana Pandit Problem and Sutra to Solve Time, Speed and Distance,Aryabhata's sum of sums, Data Management Concept, Data Types (Primitive and Non-Primitive), Concept of array(Mapping of array elements(1,2 and 3 dimensional), Triangular and Sparse arrays), Concept of Dynamic Memory allocation(Malloc, Calloc, Realloc, Free), Types of Data Structures-Linear and Non Linear Data Structure.	**15**	**1**
2	**LINEAR DATA STRUCTURE** **Stack:** Concept of stack, Operations on stack, Application of Stack (Conversion of infix-postfix forms, evaluation of postfix expression, recursion), **Queue:** Introduction, Representation of queue, Operations on Queue, Circular Queue, Priority Queue (Only Theory), Applications of queue. **Linked List:** Singly Linked List (Insert, Delete, Copy, Concatenate), Doubly Linked List(Insert, Delete), Circular Linked List(Insert, Delete)	**15**	**1**
3	**NONLINEAR DATA STRUCTURE** **Tree:** Concepts of tree, **Binary Tree (Only Theory)** : Definition, Traversal in Binary tree(Recursive + Iterative), Creation of Binary tree from pre order and in	**15**	**1**

	order, post order and in order **Threaded Binary tree(Only Theory):** Definition and concept, finding in order successor, in order predecessor) **Binary Search Tree:** Insertion and deletion in a BST **Height Balanced tree/AVL tree (Only Theory):** Definition, Insertion and deletion in AVL trees **Graph:** Matrix Representation of graphs, Graph traversal DFS and BFS, Spanning trees, Kruskals algorithm, Prims algorithm.		
4	**Sorting Algorithms:** Bubble Sort, Selection sort, Insertion sort, Quick sort, Merge sort , Radix sort **Searching algorithms:** Linear search, Binary search	**15**	**1**

Reference Books:

1. An Introduction to Data Structures with Applications.
   By Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Data Structures
   By Seymour Lipschutz
3. Data Structures and algorithm analysis in C
   By Mark Allen weiss, Second Edition
4. An introduction to data structures and applications
   By Trembley and Sorenson Tata McGraw hill publication
5. Classic Data Structures
   By Samantha PHI Publication
6. Data Structures and Program Design in C
   By Robert Kruse, Prentice- Hall India
7. Data Structures using C and C++,
   By Tenebaum, Prentice-Hall India, IInd Edition, 1997.

Accomplishments of the student after completing the Course:

After completion of this course Student would be able to

- Students should have a solid understanding of fundamental data structures such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables
- Students should be proficient in solving algorithmic problems using appropriate data structures and algorithms. And the ability to break down complex problems, design efficient algorithms, and implement solutions.
- Proficiency in understanding and working with advanced data structures such as trees, graphs, and hash tables.
- Students should be proficient in applying dynamic programming techniques to solve optimization problems efficiently.
- Knowledge of the properties, applications, and implementations of these structures.

Gujarat University

K. S. School of Business Management and Information Technology
[Five Years' (Full – Time) M.Sc. (CA&IT) Integrated Degree Course]
First Year M.Sc. (CA&IT) (Semester - II)

Course Name: Data Structure & Algorithm-Practical

Course Code: DSC-C- IMSCIT-122P

Course Credit: 4

Course Outcomes:

After learning the course, the students should be able:

- Demonstrate proficiency in implementing fundamental data structures, including arrays, stacks, queues, linked lists, binary trees, and graphs. Students should be able to design, manipulate, and analyze these structures for efficient data management.
- Develop strong algorithmic thinking and problem-solving skills, especially in the context of sorting and searching algorithms.
- Apply data structures in solving real-world problems, such as the conversion of infix-postfix expressions, evaluation of postfix expressions, recursive problem-solving, and manipulation of linked lists
- Gain a deep understanding of graph representation and algorithms, including DFS, BFS, and minimum spanning tree algorithms (Kruskal's and Prim's).
- Acquire competence in various sorting algorithms, including Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, and Radix Sort

Contents:

Unit No.	Course Content	Hours	Credits
1	**INTRODUCTION TO DATASTRUCTURE** **Various Operations of array** • Representation of arrays, • Applications of arrays, • sparse matrix and its representation • One Dimensional Array and Multidimensional Arrays **Dynamic Memory allocation**:-Malloc() , Calloc() ,realloc() , free(). **Stack using array that performs following operations** • push: Adds an element to the top of the stack. • pop: Removes the topmost element from the stack. • isEmpty: Checks whether the stack is empty. • isFull: Checks whether the stack is full. • top: Displays the topmost element of the stack.	**15**	**1**
2	**QUEUE using array that performs following operations**:- • Enqueue: Adds an element to the rear of the queue. • Dequeue: Removes the element from the front of queue. • isEmpty: Checks whether the queue is empty or not. • isFull: Checks whether the queue is full or not.	**15**	**1**

	• Peek: Displays peek element of the queue. **Circular QUEUE using array that performs following operations**:- • Enqueue: Add an element to the rear of the circular queue. • Dequeue: Removes the element from the front of the circular queue. • isEmpty: Checks whether the queue is empty or not. • isFull: Checks whether the queue is full or not. **Singly link list** : Create, INSERT(At the front , At the end , Specific position), DELETE (At the front , At the end , Specific position) **Doubly link list :** Create, INSERT(At the front , At the end , Specific position), DELETE (At the front , At the end , Specific position) **Circular link list :** Create, INSERT(At the front , At the end , Specific position), DELETE (At the front , At the end , Specific position)		
3	**Various operations on Binary search tree**: • Insertion: Insert a node in BST. • Deletion: Delete a node from the BST. • Perform In-order, preorder and post-order traversal. **Implementation of Graphs.**	**15**	**1**
4	**Implementation of Linear Search.** **Implementation of Binary Search.** **Implementation of various sorting techniques**: Quick Sort, Merge Sort, Bubble Sort, Selection Sort, Insertion Sort.	**15**	**1**

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   by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Data Structures
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   By Tenebaum, Prentice-Hall India, IInd Edition, 1997

Accomplishments of the student after completing the Course:

Upon completing the course, Students will able to:

- Understanding the concept of arrays and dynamic memory allocation is fundamental. This topic covers mapping array elements in multiple dimensions (1D, 2D, and 3D), as well as concepts like triangular and sparse arrays
- Stacks and queues are crucial linear data structures. Students learn the concept of a stack, its operations, and practical applications such as converting infix-postfix expressions, evaluating postfix expressions, and solving recursive problems
- Linked lists are dynamic data structures that play a key role in data manipulation. Topics include operations on singly linked lists (insertion, deletion, copy, concatenate), doubly linked lists, and circular linked lists.
- Understanding the concepts of trees, especially binary trees, is essential. Traversal methods (recursive and iterative), creating binary trees from different representations (pre-order and in-order, post-order and in-order), and concepts like threaded binary trees are covered
- Matrix representation of graphs, graph traversal using Depth-First Search (DFS) and Breadth-First Search (BFS), spanning trees, and algorithms like Kruskal's and Prim's.