Uka Tarsadia University

B. Tech.
CSE / CSE (AI&ML) / CSE (CC) / CSE (CS) / CE / CE (SE) / IT
Semester IV

DATA STRUCTURES
OC4001

EFFECTIVE FROM JAN-2025

Syllabus version: 1.00

Subject Code	Subject Title
OC4001	**Data Structures**

Teaching Scheme				Examination Scheme			
Hours		**Credits**		**Theory Marks**		**Practical Marks**	**Total Marks**
Theory	Practical	Theory	Practical	Internal	External	CIE	
4	0	4	0	30	70	-	100

Objectives of the course:
● To provide knowledge of linear and non-linear data structures.
● To introduce various sorting and hashing techniques.
● To introduce concepts file organisation and B – Tree, B+ Tree operations.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: Explain basic operations of linear data structure stack, queue and linked list in various applications.
CO2: Demonstrate and apply nonlinear data structure trees to solve problem.

CO3: Demonstrate and apply nonlinear data structure graph to solve problem.
CO4: Understand and implement various elementary sorting, searching techniques and hashing.
CO5: Learn good principles of file organization and external sorting.
CO6: Learn fundamentals of B- Tree and B+ Tree and the operations.

Sr. No.	Topics	Hours
	Unit - I	
1	**Introduction and linear data structures:** Introduction of Data Structures, Arrays, Stacks and Its Application, Queues, Implementation of Queues.	8
	Unit - II	
2	**Nonlinear data structure – Tree:** Trees, and Tree Traversals, Binary Tree Representation & Binary Tree Traversal, Binary Search Trees - Searching & Insertion, and Deletion, Balanced Trees, Balanced Trees - Insertion, and AVL Trees	8
	Unit - III	

3	**Nonlinear data structure – Graph:** Introduction to Graphs, Different Graph Traversals, Depth First Search, Breadth First Search, Finding Shortest Path from the graph	8
Unit - IV		
4	**Sorting:** Types of Sorting, Heap Sort and Hashing, Sorting, Selection Sort and Bubble Sort, Insertion Sort, Quick Sort Algorithm, and Kruskal's MST Algorithm, Bucket Sort, Radix Sort, and Merge Sort	8
Unit - V		
5	**File Organisation and External Sorting:** File Organisation, Types of file organisation – Sequential, Heap, Hash, Indexed, Indexing in file organisation, File access methods, File allocation methods, External sorting, need of external sorting, External sorting techniques – External Merge sort, Multiway Merge Sort, Polyphone Merge sort, Runs formation, K-way merging, Applications of external sorting	8
Unit - VI		
6	**B- Tree and B+ Tree:** Introduction to B - Tree, Insertion in B – Tree, Deletion in B – Tree,, Complexity analysis of B – Tree operations, Introduction to B+ Tree, Insertion in B+ Tree, Deletion in B+ Tree,, Complexity analysis of B+ Tree operations,	8

Reference books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2007, Second Edition, Pearson Education.
2. Cormen, Leiserson and Rivest, "Introduction to Algorithms", 2022, Fourth Edition, MIT Press.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms" (1983), Pearson Education.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson, "Fundamentals of Data Structures in C++", 1993.

Course objectives and Course outcomes mapping:

- To provide knowledge of linear and non-linear data structures: CO1, CO2, CO3
- To introduce various sorting and hashing techniques: CO4
- To introduce concepts file organisation and B – Tree, B+ Tree operations: CO5, CO6

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction and linear data structures	✓					

2	Nonlinear data structure – Tree		✓				
3	Nonlinear Data Structures - Graph			✓			
4	Sorting				✓		
5	File organization and External sorting					✓	
6	B – Tree and B+ Tree						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓	✓	✓	✓	✓	✓
PO2		✓	✓	✓	✓	✓
PO3		✓		✓		
PO4						
PO5			✓		✓	✓
PO6						
PO7						
PO8						
PO9						
PO10						
PO11				✓	✓	✓
PO12						