

Data Structures

COURSE CODE: XXXXXXXX

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: Programming languages C and C++

Course Objectives:

1. To understand and implement linear data structures and basic representations of trees and graphs.
2. To apply various searching and sorting algorithms with analysis of their time and space complexity.
3. To implement efficient hashing techniques for optimized data access.
4. To design and apply advanced tree and heap data structures for effective data management
5. To use graphs, special trees, and string data structures in solving complex computational problems.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand and implement linear data structures and basic tree/graph representations.	Understand
CO-2	Apply searching and sorting algorithms with time and space complexity analysis.	Evaluate
CO-3	Implement hashing techniques and evaluate their efficiency.	Evaluate
CO-4	Design and apply advanced tree and heap structures for optimized data organization and retrieval.	Apply
CO-5	Use graphs, special trees, and string data structures in solving computational problems.	Apply

Course Contents:

Unit	Contents	Lectures required
1	Overview of linear data structures: array, linked list, stack, and queue	3
2	Searching and sorting algorithms – Interpolation Search, Median Search; Hashing – Hash Table, Chaining, Probing; Sorting – Merge, Quick, Radix, Bucket, and Count; Time and Space complexity analysis of searching and sorting algorithms	7
3	Implementation of Multi List, Binary Tree, K-ary Tree, Tree traversals, Threaded Binary Tree, Priority Queue using Binary Heap, Binomial Heap, and Fibonacci Heap, Heap Sort	10
4	Binary Search Tree (BST), Balanced BST: AVL Tree and RB Tree; Multiway Tree: B Tree and B+ Tree	10

5	Fundamentals of Graph, Adjacency Matrix and List; Graph Traversal using DFS and BFS, Basic Algorithms – Shortest Path and Minimum Spanning Tree	6
6	Interval Tree, Segment Tree, and String Data Structures: Suffix Tree, Tries, Suffix Array	6
Total Lectures		42

Suggested Text Book(s):

1. Aaron M. Tanenbaum, *Data Structures Using C*, Pearson Education, Year not specified.
2. Ellis Horowitz and Sartaj Sahni, *Fundamentals of Data Structures*, Illustrated Edition, Computer Science Press, Year not specified.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms*, 3rd Edition, MIT Press, 2009.
4. Dinesh P. Mehta and Sartaj Sahni, *Handbook of Data Structures and Applications*, 2nd Edition, Chapman and Hall/CRC Computer and Information Science Series, CRC Press, Year not specified.

Suggested Reference Book(s):

1. Mark Allen Weiss, *Algorithms, Data Structures, and Problem Solving with C++*, Illustrated Edition, Addison-Wesley Publishing Company, Year not specified.
2. Ellis Horowitz, Sartaj Sahni, and Dinesh P. Mehta, *Fundamentals of Data Structures in C++*, Galgotia Press, 2009.
3. Seymour Lipschutz, *Data Structures with C*, Schaum's Outline Series, McGraw Hill, 2010.
4. Sara Baase and Allen Van Gelder, *Computer Algorithms: Introduction to Design and Analysis*, Pearson Education, Year not specified.
5. Thomas H. Cormen, *Algorithms Unlocked*, MIT Press, Year not specified.
6. Debasis Samanta, *Classic Data Structures*, Prentice Hall of India, Year not specified.

Other useful resource(s):

1. Link to NPTEL course contents: <https://nptel.ac.in/courses/106102064/>
2. Link to topics related to course:
 - a. https://onlinecourses.nptel.ac.in/noc18_cs25/preview
 - b. <https://nptel.ac.in/courses/106103069/>
 - c. <http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html>

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	Average
CO-1	3	2	2	1	2	1	1	1	1	1	2	1.5
CO-2	3	3	2	2	3	1	1	1	1	1	2	1.8
CO-3	3	2	2	2	3	1	1	1	1	1	2	1.7
CO-4	3	3	3	2	3	1	1	1	1	1	2	1.9
CO-5	3	3	3	2	3	1	1	1	1	1	2	1.9
Average	3	2.6	2.4	1.8	2.8	1	1	1	1	1	2	