COURSE TITLE: Data Structures and Algorithms-I

A Core Course (UG1) for CSE/ECE
Course Level: Core
L-T-P-C: 2 - 2 - 3 - 4

Prerequisites: 1. Intro to C programming 2. Overview of Computers
Note: The course number and name might vary based on the
semester/year.

Outline: Topics include elementary data structures, (including arrays,
stacks, queues, and lists), advanced data structures (including trees
and graphs), the algorithms used to manipulate these structures

Course Objectives: To assess how the choice of data structures and
algorithm design methods impacts the performance of programs. To
choose the appropriate data structure and algorithm design method for
a specified application. To write programs using procedure-oriented
design principles.

COURSE OUTLINE (TOPICS): The following list of topics is very
tentative.
Based on available time slots, some topics may be dropped or added or
reordered. No. of hours may vary as per the requirement of any
particular topic(s).

Unit – I (No of hours: 7)

C REFRESHER and ALGORITHMIC ANALYSIS
ARRAYS AND LINKED LISTS: Storage structures for arrays, matrix, row-
major, column-major, Sparse matrices. Linked list, Doubly linked
lists, Circularly linked lists, Dynamic storage management - Garbage
collection and compaction.

Unit – II (No of hours: 7)

STACK AND QUEUE: Stacks and queues: insertion, deletion, Stack and
queue using linked list, Circular queue, Prefix, postfix, infix
notation and conversions.

Unit – III (No of hours: 7)
TREES: Binary tree insertion, deletion, traversal (inorder, preorder
and postorder), Binary Search Tree, Threaded binary tree, AVL tree,
Extended Topics: B-tree, B+-tree (if time permits).

Unit – IV (No of hours: 7)

SORTING AND SEARCHING: Selection sort, Insertion sort, Bubble sort,
Merge Sort, Heap sort, and Quick sort, sorting in linear time, Hash
Tables.

Unit – V (No of hours: 7)

GRAPH: Representation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithm for Kruskal's and Prim's for Finding Minimum cost Spanning Trees, Dijkstra's Algorithm for finding Single source shortest paths.

TEXTBOOKS

• Seymour Lipschutz, Data Structures with C, Schaum's Outline Series
 • Langsam Yedidyah, Augenstein J Moshe, Tenenbaum M, Data Structures using C and C++, PHI.
• Weiss, Mark Allen. *Data Structures and Algorithm Analysis in C. Second Edition*. Pearson Education India. **(DSAC)**

REFERENCE BOOKS

• Horowitz, Sahni, Freed, Fundamentals of Data Structures in C, Silicon Press.
• Kruse R., Data Structures and Program Design in C, Pearson Education India.
• Cormen et al. Introduction to Algorithm 3rd Edition. MIT Press, 2017.

COURSE WORK:

Course grades will be based on the following weightage pattern. This is purely indicative and necessary modification will be made by the faculty depending on the intensity of the different work assigned for various tasks.

    a) EXAMINATIONS: 50%

        Mid Semester - 1 Exam: 15%
        Mid Semester - 2 Exam: 15%
        End Semester Exam: 20%

    b) Assignments: 30%

    c) Lab Exam: 20%

Industrial Relevance: Used in all software industries and significant role in tech giants like Google, Facebook, Amazon, Flipkart where interviews are more focused on measuring the knowledge of Data Structures and Algorithms of the candidates.

Companies: https://www.naukri.com/data-structures-jobs
Tech giants like Amazon, Microsoft, Google, Flipkart, Walmart, Amadeus, Facebook to name a few

Similar Courses:
http://www.cse.iitd.ernet.in/~naveen/courses/CSL201/index.html

Course Ethics: 1. We expect students to work alone on all programming assignments. There are no group projects or assignments in this course.
2. Using the internet for help with syntax and compilation errors will be tolerated. But, a student should never copy paste a solution (or partial solution) from any online source.
3. Plagiarism in any shape or form will not be tolerated and will be dealt with very severely.

Week Wise Plan:

Week 1	Course Introduction, C Refresher
Week 2	Asymptotic Analysis
Week 3	Recursive and Iterative Analysis
Week 4	Sorting: insertion, bubble, selection, merge, searching: linear and binary
Week 5	Quick sort, heap sort
Week 6	Hash table
Week 7	Stacks and Queues
Week 8	Linked List
Week 9	Binary tree
Week 10	Avl tree, B, B+ trees
Week 11	Graphs: DFS, BFS
Week 12	Minimum Spanning Tree

Session Wise Plan:
Mid 1:

| Course Introduction, C Refresher |
| Asymptotic Analysis |
| Recursive and Iterative Analysis |
| Sorting: insertion, bubble, selection, merge, searching: linear and binary |

Mid 2:

| Sorting: insertion, bubble, selection, merge, searching: linear and binary |
| Quick sort, heap sort |
| Hash table |
| Stacks and Queues |
| Linked List |

Mid 3:

| Binary tree |
| Avl tree, B, B+ trees |
| Graphs: DFS, BFS |
| Minimum Spanning Tree |

Pending Topics:
Linked List (Doubly and Circular)
Mid 3:

Binary tree
Avl tree, B, B+ trees
Graphs: DFS, BFS
Minimum Spanning Tree

Resources: http://web.iitd.ac.in/~csz188551/COL106 2019/
http://web.stanford.edu/class/cs161/schedule.html
http://web.stanford.edu/class/cs166/

Submitted By:
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