Guru Nanak Dev Engineering College, Ludhiana

Department of Computer Science & Engineering

Scheme and Syllabus

B. Tech. Computer Science & Engineering (2018 Batch Onwards)

Subject Code: PCCS-106

Subject Name: Data Structures

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 4	**Teaching Hours:** 37
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 50%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Programming for Problem Solving and OOPS

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Apply knowledge of statistics and programming skills to solve complex engineering problems related to data structures.
2	Make use of Research based knowledge to identify the appropriate data structure and provide better solution to reduce space and time complexity.
3	Identify, Formulate and analyse data structure to develop skills and understand their applications to perform operations on it.
4	Design appropriate algorithm for autonomous realization of sub-programs to model complex engineering activities.
5	Demonstrate various methods of organizing large amounts of data and recognize systematic way to retrieve data and solve problems.
6	Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.

Detailed Contents:

Part-A

Basic concepts: Concept of data type, Linear and non-linear data structures, Data structures versus data types, Operations on data structures, Algorithm complexity and Asymptotic notations.   **[2 Hours]**

Arrays: Linear and multi-dimensional arrays and their representation, Operations on arrays, Sparse matrices and their storage.   **[2 Hours]**

Stacks: Sequential representation of stacks, Operations on stacks, Application of stacks – parenthesis checker, Evaluation of postfix expressions, Conversion from infix to postfix, Conversion from infix to prefix representation, Tower of Hanoi problem, implementingrecursive functions.   **[5 Hours]**

Queues: Sequential representation of queue, Types of queue- Linear Queue, Circular Queue, Deque, Priority Queue, Operations on each types of Queues and their algorithms, Applications of Queues. **[4 Hours]**

Linked List: Definition and representation of Linked list, Types of Linked list- Linear linked list, Doubly linked list, Circular linked list and Header linked list and their operations, Application of linked lists, Garbage collection and compaction, Linked representation of Stack and Queues and their algorithm.   **[6 Hours]**

Part-B

Trees: Basic terminology, Sequential and linked representations of trees, Different types of Trees- Binary Tree, Binary search tree, Threaded binary tree, AVL tree and B-tree. Operations on each of the trees. Application of Binary Trees.   **[5 Hours]**

Graphs: Basic terminology, Representation of graphs – Adjacency matrix, Adjacency list. Operations on graph, Traversal of a graph – Breadth first search, Depth first search. Shortest path algorithms – Dijkstra's and Floyd. Minimum spanning tree – Prim and Kruskal. Applications of graphs.   **[4 Hours]**

Heaps: Representing a heap in memory, Operations on heaps, Application of heap in implementing priority queue and Heap sort algorithm.   **[2 Hours]**

Hashing and Hash Tables: Introduction to hash table, Hash functions, Concept of collision and its resolution using open addressing and separate chaining, Double hashing, Rehashing.   **[2 Hours]**

Searching and Sorting: Linear and binary search techniques, Sorting methods – Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Shell sort and radix sort. Complexities of searching and sorting algorithms.   **[5 Hours]**

Text Books

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw Hill.

 2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Tata McGraw Hill.

Reference Books

1. Michael T. Goodrich, Roberto Tamassia, & David Mount, "Data Structures and Algorithms in C++", Wiley India.

2. Kruse, "Data Structures &ProgramDesign", Prentice Hall of India.

3. Y. Langsa, M.J. Augenstein, A.M. Tanenbaum, "Data structures using C and C++", Prentice Hallof India.

4. Vishal Goyal, LaliGoyal, Pawan Kumar, " Simplified Approach to Data Structures", Shroff Publications and Distributors

E-Books and online learning material

1. Data Structures and Algorithms: byGranville Barnett, and Luca Del Tongo. https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf

2. Data Structures and Algorithms in JAVA :by Michael T. Goodrich and Roberto Tamassiahttp://enos.itcollege.ee/~jpoial/algorithms/GT/Data%20Structures%20and%20Algorithms%20in%20Java%20Fourth%20Edition.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106102064/
2. https://nptel.ac.in/courses/106106133/
3. https://nptel.ac.in/courses/106106145/
4. https://www.youtube.com/watch?reload=9&v=YWnBbNj_G-U