

Semester: Year 1 Semester 2 Program: B.Tech Session: 2024-2025

Course Code: CSD102 Course Title: Data Structures LTPC: 3 0 1 4

Course Instructor: Pooja Singh Email: pooja.singh@snu.edu.in

Office: C219J

TA: Durgesh Dixit (durgesh.dixit@snu.edu.in), Kaluram Kalbi (kalu.kalbi@snu.edu.in) and Ishant Gaba (ig481@snu.edu.in)

Office hours: By Email Appointment

**Course Contents:** The purpose of this course is to provide the students with solid foundations in the basic concepts of data structures. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter. This course is also about showing the correctness of algorithms and studying their computational complexities. This course offers the students a mixture of theoretical knowledge and practical experience.

The study of data structures and algorithms is carried out within a structured framework using C programming language for the implementations.

## **Course Learning Outcomes**

Having successfully completed this course, the student will be able to achieve the following: (1) Ability to analyze algorithms and their complexities (Time and Space). (2) Understand and use the concept of Abstract Data Types such as Linked Lists, Stacks and Queues. (3) Understand and apply singly Linked List, Doubly Linked List and Circular Linked List. (4) Ability to implement stacks and queues using arrays and linked data structures. (5) Ability to handle operations like searching, sorting, insertion, deletion, traversing mechanism etc. on various data structures. (6) Understand the concept of hashing for associating keys with data for faster access. (7) Understand and implement Binary Trees, Complete Binary Tree, Binary Search Trees, AVL trees, B-Trees, Heap trees and concept of Priority Queues. (8) Understand and implement Graphs and Graph Algorithms.

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Prerequisites: Introduction to Computing and Programming (Course Code CSD-101).

### **Text Book:**

• "Data Structures and Algorithm Analysis in C" by Mark Allen Weiss

#### References:

- Fundamentals of Data Structures in C, Horowitz and Sahni
- Data Structures and Algorithms in C by Goodrich and Tamassia
- Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.
- Y. Langsam, M. J. Augenstein, and A. M. Tanenbaum, "Data Structures Using C and C++", Second Edition, Pearson, 2015.
- E. Balagurusamy, "Data Structures Using C", McGraw-Hill, 2017.
- Yashavant P. Kanetkar, "Data Structures Through C", Second Edition, BPB Publications, 2003.
- ISRD Group, "Data Structures Using C", Tata McGraw-Hill, 2006.

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#### Module 1: Introduction

Data structures and classification of Data Structures.

Introduction to Abstract Data Types (ADT)

Introduction to O,  $\Omega$  and  $\Theta$  and time/space complexity.

## Module 2: Arrays and Linked Lists

Arrays as ADT, storage representations, representation of polynomials using arrays.

Linked Lists as ADT, operations using linked lists, Header Linked Lists, Doubly Linked Lists, Circular Linked Lists

Dynamic Memory Management.

#### Module 3: Stacks and Queues

Arrays, Linked Lists and ADT representation of stacks and queues

Polish notations using stacks, queues operations, circular queues, dequeue, priority queues.

## Module 4: Trees and Graphs

Traversal of Binary Trees, Threaded Binary Trees, Binary Search Trees (BST), Balanced Binary Trees, AVL search trees, m-way search trees, B-trees.

Spanning Trees, Minimum Spanning Trees Algorithms – Prim's and Kruskal's Algorithms

Introduction to Directed and bi—connected graphs.

## Module 5: Hashing

Introduction to different hashing techniques and functions.

### Laboratory:

- Advance C programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems.
- Implementation of abstract data types such as linked list, stack, queue, tree and graphs.
- C Programs that apply abstract data types.

#### **Evaluation Scheme**

- 1. Mid Semester Examination 25%
- 2. Quizzes 20%
- 3. Laboratory Assignments 20%
- 4. End Semester Examination 30%
- 5. Class Participation 5%

#### **Course Policies**

- Maintain a notebook and keep notes for each and every lecture. A student can maintain digital Notebook as well.
- Lecture slides will be regularly posted.
- Submit assignments on time. Assignment submitted after due date will not be evaluated.
- Class practice assignments (based on certain modules) should be completed by students during class timings only.
- The use of Cell Phones will not be allowed during graded labs/ class assignments/ quiz/ midterm/ end term. The same will be proctored using an authentic proctoring tool. If found, student will be disqualified.
- No social Networking/non relevant sites should be opened during the class.
- No food and drinks allowed in the class.
- Bonus points may be given during the semester in the form of quizzes and assignments.
- See Announcement Section regularly for other information.

## **Grading Policy**

Scores obtained in all the components of Evaluation shall be totaled and the final score will be converted into letter grades relatively. Students taking this course to improve their earlier grade are reminded that this grade **replaces** the previous grade (regardless of which is higher). However, 'A' Grade will not be awarded for any score less than 80. That means lower bound of 'A' could be more than equal to 80%. Grade 'D' will not be assigned ≤ 30% but can be more than 30% as per normal distribution.

Students taking this course to improve their earlier grade are reminded that this grade **replaces** the previous grade (regardless of which is higher).

# **Cheating Policy**

Any attempt to pass of someone else's work as your own or to assist someone else in such an effort is considered cheating. Familiarize yourself with the University policy on **Academic Malpractice & Plagiarism**.

## **Attendance and Participation**

The nature of the class makes participation essential.

The attendance (for Lectures) will be initiated sharp at **10:30 AM**. That means, students can mark their attendance till **10:40 AM** on the Biometric Machines. Students marking their attendance after the stipulated time, will be bydefault marked as absent and no excuses will be granted in this perspective.

# Make up Policy

No make-up will be granted for any component of evaluation unless (a) you have emailed Course Instructor with necessary reason(s) as soon as possible **before** the date of evaluation and a make-up date has been agreed upon, <u>or</u> (b) unforeseeable circumstances prevent you from keeping the original date. In either case, you may need to submit supporting documents. The decision of the Course Instructor in all these matters shall be final.