Geethanjali College of Engineering and Technology (Autonomous)
Accredited by NAAC with A^{+} Grade; B.Tech. CSE, EEE, ECE accredited by NBA
Sy. No: 33 & 34, Cheeryal (V), Keesara (M), Medchal District, Telangana – 501301

25CS12001: DATA STRUCTURES

B. Tech.CSE(AIML) – I Year, II Sem.
Prerequisite(s): 25CS11001-Programming for Problem Solving

L	T	P/D	C
3	-	-/-	3

Course Objectives: Develop ability to

1. **Introduce students to advanced data representation techniques** in C using structures, unions, enumerations, and typedef to effectively organize and manipulate complex data types.
2. **Proficiency in file handling and data storage concepts**, including text and binary file operations, database searching, file positioning, and multifile program design.
3. **Build foundation in abstract data types and linear data structures**, enabling students to implement and manage linked lists, circular lists, and doubly linked lists for efficient data organization.
4. **Train students in the use of stacks and queues** for solving computational problems such as expression conversion, evaluation, and balancing of symbols through algorithmic thinking.
5. **Equip students with knowledge of hierarchical and network data structures**, including trees and graphs, and their associated algorithms for searching, traversal, and application in problem-solving.

Course outcomes (COs): At the end of the course, student would be able to

CO 1 Apply user-defined data types such as structures, unions, and enumerations to represent complex data.
CO 2 Implement file operations on text and binary files for data storage, retrieval, and maintenance.
CO 3 Develop and manipulate linear data structures including linked lists, stacks, and queues.
CO 4 Design and execute algorithms for trees and graphs including traversal, searching, and updating.

CO	Related POs and PSOs	Related Units	BTL	Related SDGs
CO1	PO1, PO2, PSO1	Unit I	BTL 2,3	SDG4
CO2	PO1, PO2, PO3, PSO2	Unit II	BTL 3,4	SDG 9
CO3	PO1, PO3, PO4, PSO1	Unit III, IV	BTL3, 4	SDG 8
CO4	PO1, PO4, PO5, PSO2	Unit V	BTL 4,5	SDG 9

UNIT – I: Structure and Union Types
Introduction, User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Complex Structures, Self-Referential Structures, Bit Fields, Union Types, typedef, Enumeration.

UNIT – II: Text and Binary File Pointers

Files Introduction, Modes of File, Input/ Output Files - Review and Further Study, Binary Files, Searching a Database, File status functions, File positioning functions, Command Line Arguments, Multi file Programming.

UNIT–III: Introduction to Data Structures:

Abstract data types, selecting a Data Structure, Linear list ―Introduction, singly linked list, Circular Linked Lists, Doubly Linked List.

UNIT – IV: Stacks

Stack ADT, Stack applications -Infix Expression to Postfix Expression Conversion, Postfix Expression Evaluation, Balancing Symbols, Expression Tree, Queues- Queue ADT

UNIT – V: Trees and Graphs

Introduction, Types of Trees, creating a Binary Tree from a General Tree, traversing a Binary Tree, Binary Search Trees (BST), BST Operations- Searching, Insertion and Deletion, BST ADT.

Introduction to types of Graphs, Representation of Graphs, Graph Traversal Algorithms – Depth First Search, Breadth First Search, Graph ADT, and Applications of Graphs.

TEXTBOOKS:

1. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.GilbergandB. A.Forouzan, Cengage Learning.
2. Data Structure using C–ReemaThareja,3rd Edition, Oxford University Press.
3. C Programming and Data Structures, B.A. Forouzan and R.F. Gilberg, Cengage Learning, (3rd Edition).

REFERENCE:

1. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.
2. The C Programming Language Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.

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25CS12L01: DATA STRUCTURES LAB

B. Tech.CSE(AIML) – I Year, II Sem.
Prerequisite(s): Programming for Problem Solving

L	T	P/D	C
-	-	2/-	1

Course Objectives: Develop ability to

1. Introduce students to advanced data representation techniques in C using structures, unions, enumerations, and typedef to effectively organize and manipulate complex data types.
2. Proficiency in file handling and data storage concepts**,** including text and binary file operations, database searching, file positioning, and multifile program design.
3. Build foundation in abstract data types and linear data structures, enabling students to implement and manage linked lists, circular lists, and doubly linked lists for efficient data organization.
4. Train students in the use of stacks and queues for solving computational problems such as expression conversion, evaluation, and balancing of symbols through algorithmic thinking.
5. Equip students with knowledge of hierarchical and network data structures**,** including trees and graphs, and their associated algorithms for searching, traversal, and application in problem-solving.

Course outcomes (COs): At the end of the course, student would be able to

CO 1 Develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.

CO 2 Implement the concepts of Trees and Graphs

CO	Related POs and PSOs	Related Units	BTL	Related SDGs
CO1	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2	I, II, III, IV	BTL-3, BTL-4	SDG4, SDG8, SDG9
CO2	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2	V	BTL-4	SDG4, SDG9

List of Experiments

1. Write a program that uses functions to perform the following operations on singly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal

2. Write a program that uses functions to perform the following operations on doubly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implement stack (its operations) using
   i) Arrays ii) ADT
5. Write a program that implement Queue (its operations) using
   i) Arrays ii) ADT
6. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).
7. Write a program to implement Binary Search tree
8. Write a program to implement the Graph traversal methods.
   i) DFS ii) BFS

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A.Forouzan, Cengage Learning.