CSS 2101 DATA STRUCTURES [3 1 0 4]
(Effective from the academic year 2025-26)
SEMESTER - III

Subject Code	**CSS 2101**	**IA Marks**	50
Number of Lecture Hours/Week	**04**	**Exam Marks**	50
Total Number of Lecture Hours	**48**	**Exam Hours**	**03**

CREDITS - 04

Abstract syllabus
Arrays, Sparse Matrix, Pointers and array of Pointers, Recursion, Memory allocation functions, Structures and array of structures, Linear Search, Binary Search, Sorting Techniques, Singly Linked List and Chains, Doubly Linked Lists, Circular Linked Lists, Linked Lists with Header Node, Applications using linked lists, Polynomials, Additional List Operations, Stacks, Queues, Circular Queues, Priority Queues and their Representation, Double Ended Queue, Input/Output Restricted Queues, Evaluation of Expression, Infix, Postfix and Prefix expressions and their conversions, Linked stacks and Linked Queues. Representation of Trees, Binary Trees, Expression tree, Binary Tree Traversals, Additional Binary Tree Operations, Threaded Binary Trees, Binary Search Trees - Definition, searching a Binary Search Tree, Inserting into and Deletion from Binary Search Tree, AVL trees, Red-Black Trees, Introduction, Definitions, Graph Representations, Depth First Search, Breadth First Search.

Course objectives: This course will enable students to

- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues and Linked Lists
- Analyze Non-Linear Data Structures: Trees and Graphs

Module -1	**Teaching Hours**
Introduction and Fundamentals: Arrays – operations, applications, Pointers and array of pointers, Recursion – function recursion and applications, Memory allocation functions (malloc, calloc, free, realloc), Structures and array of structures, Searching Techniques – Linear Search, Binary Search, Sorting Techniques, Sparse Matrix – representation and operations **R1:** Chapter 6: 6.9, Chapter 8: 8.1-8.8, Chapter 9: 9.1-9.3, Chapter 10: 10.1-10.5, Chapter 12:12.3 **R2:** Chapter 2: 2.4.1,2.4.2	**12 Hours**

Module -2	
LINKED LISTS: Singly Linked List and Chains, Representing Chains in C, Doubly Linked Lists, Circular Linked Lists, Linked Lists with Header Node, Linked Lists Applications – polynomial operations, Additional List Operations – Operations for Chains, Operations for Circularly Linked Lists **R2:** Chapter 4: 4.1 – 4.5, 4.8	**12 Hours**
Module – 3	
STACKS and QUEUES: Stacks and operations, Queues – linear, circular, Evaluation of Expressions – infix, postfix, prefix and conversions, Multiple Stacks and Queues, Priority Queues and their representation, Double Ended Queue (Deque), Input/Output Restricted Queues **R2:** Chapter 3: 3.1, 3.2, 3.4,3.5, Chapter 5: 5.6.1,5.6.2	**9 Hours**
Module-4	
TREES: Terminology, Representation of Trees, Binary Trees – operations and expression trees, Binary Tree Traversals: inorder, preorder, postorder, Additional Binary Tree Operations, Threaded Binary Trees, Binary Search Tree – definition, search, insertion, deletion, AVL Trees – rotations, balancing, Red-Black Trees **R2:** Chapter 5: 5.1-5.4.2, 5.5, 5.7.1-5.7.4, Chapter 10: 10.2,10.5	**11 Hours**
Module-5	
GRAPHS: Introduction, Definitions, Graph Representations- adjacency matrix, adjacency list, Depth First Search (DFS) , Breadth First Search (BFS) **R2:** Chapter 6: 6.1, 6.2.1, 6.2.2	**4 Hours**
Course outcomes:	
After studying this course, students will be able to: 1. Associate real world representation of information using structures and recursions. 2. Understand and solve real world problems using linked list concepts. 3. Solve real world problems using concepts like queues and stacks. 4. Analyze Non-Linear Data Structures such as Trees. 5. Understand Graph representations and Graph traversals.	
References: 1. Behrouz A. Forouzan, Richard F. Gilberg, A Structured Programming Approach Using C,(3e), Cengage Learning India Pvt. Ltd, India, 2007. 2. Ellis Horowitz, Sartaj Sahani, Susan Anderson and Freed, Fundamentals of Data Structures in C, (2e), Silicon Press, 2007.	

3. Richard F. Gilberg, Behrouz A. Forouzan, Data structures, A Pseudocode Approach with C, (2e), Cengage Learning India Pvt. Ltd, India, 2009.
4. Tenenbaum Aaron M., Langsam Yedidyah, Augenstein Moshe J., Data structures using C, Pearson Prentice Hall of India Ltd., 2007.
5. Debasis Samanta, Classic Data Structures, (2e), PHI Learning Pvt. Ltd., India, 2010.
6. https://onlinecourses.swayam2.ac.in/cec25_hs62/preview [Introduction to Data Structures, Punjabi University, Patiala].