CSE213: Data Structures and Algorithms

Programme: B.Tech. **Year:** I **Semester:** Second
Course: Institute Core **Credits:** 3 **Hours :** 40 hours (Theory)

Course Context and Overview (100 words):

a. To learn and understand how the choice of data structures and algorithm impacts the design and performance of programs;
b. To learn the appropriate data structures and algorithms to design and implement a specified application;
c. To learn the systematic ways for solving problems using efficient and effective data-structures of organizing in-memory data;
d. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, multi-way trees, and search trees;
e. To learn basic algorithms for solving problems related to trees and graphs including spanning trees, node connectivity, graph traversals, Huffman coding, shortest paths, matching.

Prerequisite Courses: Computer Programming

Course Outcomes (COs):

CO1:	An ability to understand the structure, properties and operations of various data structures.
CO2:	An ability to implement different data structures and related algorithms.
CO3:	An ability to choose and employ data structures for solving various programming problems and applications, and modelling the information in the problems.

Course Topics

Contents	Lecture Hours
UNIT – 1 Complexity Analysis	1.5
Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, introduction to data structures and algorithms.	

UNIT –2 Linear Lists	4.5
Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked representation, singly linked lists, doubly linked lists, circular lists.	
UNIT-3 Stacks and Queues	4.5
Abstract data types. Stacks and Queues disciplines: sequential and linked implementations. Applications of stack: Parenthesis/brackets matching, Expression conversion, Expression evaluation. Queues and Circular Queues: concepts and implementation.	
UNIT-4 Trees and Tree algorithms	4.5
Binary trees and their properties, terminology, sequential and linked implementations. Tree algorithms: Tree traversal methods and algorithms. Huffman coding.	
UNIT-5 Basics of Graphs	3
Definition, terminology, directed and undirected graphs, properties, implementation – adjacency matrix and linked adjacency chains.	
UNIT-5 Mid-Semester Revision	1.5
Catch up and revision	
UNIT-5 Search Trees	6
Binary search trees, search efficiency, insertion and deletion operations, traversal operations, importance of balancing, AVL trees, searching insertion and deletions in AVL trees, comparison with AVL trees, search insert and delete operations.	
UNIT-7 Multi-way Trees	3
Issues in large dictionaries, 2-3-way search trees, search insert and delete operations, height of 2-3 Trees; k-way B-tree.	
UNIT-8 Hashing and Heaps	3
Search efficiency in lists; hashing as a search structure, hash table, collision avoidance, linear open addressing, chains; heaps as priority queues, heap implementation, insertion and deletion operations, heap sort;	
UNIT-9 Basic Graph algorithms as Example of Data-Structure Applications	6

A selection of algorithms such as: graph traversal algorithms, graph connectivity algorithms, closures, matching algorithms, spanning trees, shortest path algorithms, topological sorting.	
UNIT-10 End of semester revision	1.5
Semester review	

Textbook references (IEEE format):
Text Books:

1. Reema Thareja, *Data Structures using C*, Oxford University Press, 2014 (2nd End).
2. Aho A.V., J.E. Hopcroft, J.D. Ullman, *Data Structures and algorithms*, Pearson

Reference books:

1. Robert L. Kruse, Bruce P. Leung, Clovis L. Tondo, "*Data Structures and Program Design In C" (2nd Edition)*, Prentice Hall, 1996.
2. Horowitz and Sahni, "*Data Structure in C++"*, Glagotia.
3. Ellis Horowitz, Sartaj Sahni, "*Fundamentals of Data Structures"*, Computer Science Press.
4. Niklaus Wirth, "*Algorithms + Data Structures = Programs"*, Prentice-Hall Series in Automatic Computation.
5. Sartaj Sahni, "*Data Structures, Algorithms, and Applications in C++"*, TMH.
6. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, "*Data Structures Using C"*., PHI Learning (2009).
7. Mark Allen Weiss, "*Data Structures and Algorithm Analysis in C++"*, (2nd Edition)

Evaluation Methods:

Item	Weightage (%)
Mid Term	35
Quiz (Announced and as needed)	10
Group project	10
End Term Examination	40
Attendance (>>Minimum)	05

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