ADVANCED DATA STRUCTURES

I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC02	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course covers some of the general-purpose data structures and algorithms in software development phases. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. 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 in problem solving in mathematical and engineering areas.

II. COURSE OBJECTIVES:

The students will try to learn:

1. The performance trade-offs of different algorithms / implementations and asymptotic analysis of their running time and memory usage.
2. The knowledge of basic abstract data types (ADT) and associated algorithms to perform various operations on different types of data structures.
3. The fundamentals of how to store, retrieve, and process the data efficiently.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	**Analyze** the performance and complexity of the algorithms on data structures and their applications using mathematical tools like asymptotic notations.	Understand
CO2	**Construct** complex data structures for processing, organizing, and accessing information	Understand
CO3	**Design** and Implement non-linear data structures using trees and graphs.	Understand
CO4	**Organize** data in the form of trees and graphs for retrieving information effectively.	Apply
CO5	**Model** the real-world data using red black and splay trees for comparison of text, patterns, and querying.	Understand

MODULE-I: OVERVIEW OF DATA STRUCTURES (09)

Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples; Data structures: Linear and nonlinear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT, implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linkedlist.

MODULE-II: DICTIONARIES, HASH TABLES (09)

Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

MODULE-III: TREES AND GRAPHS (09)

Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT, representations, recursive and non recursive traversals, threaded binary trees.

Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's

algorithm for single source shortest path problem.

MODULE-IV: SEARCH TREES I (09)

Binary search tree: Binary search tree ADT, insertion, deletion and searching operations, finding the parent of a given node, attaining a reference to a node, finding the smallest and largest values in the binary search tree; Balanced search trees: AVL trees, definition, height of an AVL tree; Operations: Insertion, deletion and searching.

MODULE-V: SEARCH TREES II (09)

Red-Black and Splay Trees; B trees: Definition, operations and applications; R trees: Nearest neighbor query, join and range queries; Comparison of search trees; Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.

V TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G.A.V.Pai, "Data Structures and Algorithms",Tata McGraw Hill, NewDelhi,1stEdition,2008.
3. M. A. Weiss, Addison Wesley, "Data Structures and Algorithm Analysis in Java", Pearson Education, 2nd Edition, 2005.

VI. REFERENCE BOOKS:

1. D. Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hop craft, Ullman, "Design and Analysis of Computer Algorithms", Pearson Education India, 1st Edition, 1998.
3. Goodman, Hedetniemi, "Introduction to the Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.
4. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Course Technology, 3rd Edition, 2005.
5. M.T.Goodrich, R.Tomassia, "Data structures and Algorithms in Java", Wiley India, 3rdEdition, 2011.

VII WEB REFERENCES:

1. http://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. http://www.geeksforgeeks.org/b-tree-set-1-introduction-2/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

VIII E-TEXT BOOKS:

https://comsciers.files.wordpress.com/2015/12/horowitz- -of-computer-algorithms-2nd-edition.pdf