

Savitribai Phule Pune University Second Year of Computer Engineering (2015 Course) 210252: Advanced Data Structures		
Teaching Scheme: TH: 04 Hours/Week	Credit 04	Examination Scheme: In-Sem(online): 50 Marks End-Sem(paper): 50 Marks
Prerequisite: <ul style="list-style-type: none"> • Data Structures and algorithms • Basic Mathematics, Geometry, linear algebra, vectors and matrices. 		
Course Objectives: <ul style="list-style-type: none"> • To develop a logic for graphical modelling of the real life problems. • To suggest appropriate data structure and algorithm for graphical solutions of the problems. • To understand advanced data structures to solve complex problems in various domains. • To operate on the various structured data • To build the logic to use appropriate data structure in logical and computational solutions. • To understand various algorithmic strategies to approach the problem solution. 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> • To apply appropriate advanced data structure and efficient algorithms to approach the problems of various domain. • To design the algorithms to solve the programming problems. • To use effective and efficient data structures in solving various Computer Engineering domain problems. • To analyze the algorithmic solutions for resource requirements and optimization • To use appropriate modern tools to understand and analyze the functionalities confined to the data structure usage. 		
Course Contents		
Unit I	Trees	09 Hours
Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals- inorder, preorder, post order, level wise -depth first and breadth first, Operations on binary tree. Binary Search Tree (BST), BST operations, Threaded binary tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary tree, in order traversal of in-order threaded binary tree. Case Study- Use of binary tree in expression tree-evaluation and Huffman's coding		
Unit II	Graphs	09 Hours
Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Introduction to Greedy Strategy, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prim's and Kruskal Algorithms, Dijkstra's Single source shortest path, Topological ordering. Case study- Data structure used in Webgraph and Google map.		

Unit III	Hashing	09 Hours
Hash Table- Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing. Dictionary- Dictionary as ADT, ordered dictionaries. Skip List- representation, searching and operations- insertion, removal.		
Unit IV	Search Trees	09 Hours
Symbol Table- Representation of Symbol Tables- Static tree table and Dynamic tree table, Introduction to Dynamic Programming, Weight balanced tree, Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, Height Balanced Tree- AVL tree.		
Unit V	Indexing and Multiway Trees	09 Hours
Indexing and Multiway Trees- Indexing, indexing techniques, Types of search tree- Multiway search tree, B-Tree, B+Tree, Trie Tree, Splay Tree, Red-Black Tree, K-dimensional tree, AA tree. Set- Set ADT, realization of Set and operations. Heap- Basic concepts, realization of heap and operations, Heap as a priority queue, heap sort		
Unit VI	File Organization	09 Hours
Sequential file organization- concept and primitive operations, Direct Access File- Concepts and Primitive operations, Indexed sequential file organization- concept, types of indices, structure of index sequential file, Linked Organization- multi list files, coral rings, inverted files and cellular partitions. External Sort- Consequential processing and merging two lists, multiday merging- a k way merge algorithm.		
Books:		
Text:		
<ol style="list-style-type: none"> 1. Horowitz, Sahani, Dinesh Mehata, –Fundamentals of Data Structures in C++”, Galgotia Publisher, ISBN: 8175152788, 9788175152786. 2. M Folk, B Zoellick, G. Riccardi, –File Structures”, Pearson Education, ISBN:81-7758-37-5 3. Peter Brass, –Advanced Data Structures”, Cambridge University Press, ISBN: 978-1-107-43982-5 		
References:		
<ol style="list-style-type: none"> 1. A. Aho, J. Hopcroft, J. Ulman, –Data Structures and Algorithms”, Pearson Education, 1998, ISBN-0-201-43578-0. 2. Michael J Folk, –File Structures an Object Oriented Approach with C++”, Pearson Education, ISBN: 81-7758-373-5. 3. Sartaj Sahani, –Data Structures, Algorithms and Applications in C++”, Second Edition, University Press, ISBN:81-7371522 X. 4. G A V Pai, –Data Structures and Algorithms”, The McGraw-Hill Companies, ISBN - 9780070667266. 5. Goodrich, Tamassia, Goldwasser, –Data Structures and Algorithms in Java”, Wiley Publication, ISBN: 9788126551903. 		