

1. OCA- Oracle Certified Associate
2. OCP- Oracle Certified Professional

Course Code: IT-12

Course Name: Data Structure and Algorithms

Credit Scheme			Evaluation Scheme				
Lecture	Practical	Credit	Internal			External	Total
			Written	Practical	Tutorial		
3 Hrs./Week	-	3	25	-	-	50	75

Course Description:

Prerequisite

Loops, Functions, Pointers, Arrays, Memory Allocation, Recursion

Course Objectives:

1. To understand basics data structure and algorithms
2. To solve problems using data structures such as linked lists, stacks, queues, hash tables, trees, heaps and graphs
3. To understand various programming techniques such as brute force, greedy, dynamic programming, divide-conquer and backtracking

Course Outcomes:

Student will be able to

- CO1: demonstrate linear data structures linked list, stack and queue (apply)
- CO2: implement tree, graph, hash table and heap data structures (apply)
- CO3: apply brute force and backtracking techniques (apply)
- CO4: demonstrate greedy and divide-conquer approaches (apply)
- CO5: implement dynamic programming technique (apply)

Course Structure:

Sr. No.	Topics Details	Weightage in %	No of Sessions
1	Linked List 1.1 Singly Linked List 1.2 Doubly Linked List Extra Reading: Circular Linked list and Circular doubly linked list	8	2
2	Stack and Queues 2.1 Linked List implementation of Stack 2.2 Linked List implementation of Queue	10	4

	2.3 Circular Queue 2.4 Priority Queue Extra Reading: Dqueue, Application of Stack		
3	Tree 3.1 Tree 3.2 Binary Search Tree 3.3 AVL Tree 3.4 Red-Black Tree 3.5 Segment Tree - with min/max/sum range queries examples 3.6 Fenwick Tree (Binary Indexed Tree) Extra Reading: Application of Tree, B* tree	12	5
4	Graph 4.1 Directed and Undirected Graph 4.2 Graph Representations 4.2.1 Adjacency Matrix 4.2.2 Adjacency List 4.3 Graph Traversals 4.3.1 BFS 4.3.2 DFS Extra Reading: Application of Graph in Maps	8	2
5	Hash Table and Heaps 5.1 Hash Table 5.1.1 Hash Function 5.1.2 Hash function approaches 5.1.3 Handling the collisions 5.2 Heap 5.2.1 Min heap and Max heap Extra Reading: Hashing used in File handling	7	2
6	Brute Force 6.1 Linear Search 6.2 Rain Terraces 6.3 Recursive Staircase 6.4 Maximum Subarray 6.5 Travelling Salesman Problem 6.6 Discrete Fourier Transform Extra Reading: Application in Cryptography	10	5
7	Greedy 7.1 Jump Game 7.2 Unbound Knapsack Problem 7.3 Dijkstra Algorithm	10	5

	7.4 Prim's Algorithm 7.5 Kruskal's Algorithm Extra Reading: Huffman's Tree		
8	Divide and Conquer 8.1 Binary Search 8.2 Tower of Hanoi 8.3 Pascal's Triangle 8.4 Euclidean Algorithm 8.5 Merge Sort 8.6 Quicksort 8.7 Fast Powering Extra Reading: Cooley-Tukey Fast Fourier Transform (FFT) algorithm	10	8
9	Dynamic Programming 9.1 Fibonacci Number 9.2 Unique Paths 9.3 Longest Common Subsequence (LCS) 9.4 Longest Common Substring 9.5 Longest Increasing Subsequence 9.6 Shortest Common Super sequence 9.7 0/1 Knapsack Problem 9.8 Integer Partition 9.9 Regular Expression Matching Extra Reading: Painting Fence Algorithm, Moser-de Bruijn Sequence, Newman-Conway Sequence	15	7
10	Backtracking 10.1 Power Set 10.2 Hamiltonian Cycle 10.3 N-Queens Problem 10.4 Knight's Tour 10.5 Combination Sum Extra Reading: Word Break Problem using Backtracking	10	5
Total:		100	45
Note: Course should be taught independent of any programming language.			

Course References:

Recommended Books:

Text Books

1. Jean Paul Tremblay, Paul G. Sorensens, "AN Introduction to Data Structure: with Application", McGraw Hall Publication (INDIAN edition)
2. A. V. Aho and J.D. Ullman, "Design and Analysis of Algorithms", Addison Wesley
3. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" P

Reference Books

1. Lipschutz Schaum's, "Data Structure", Outline Series, MH
2. D. Samanta, "Classical Data Structure", PHI,
3. Practical Approach to Data Structures by Hanumanthappa.
4. Data Structure and Algorithms in C++ by Joshi Brijendra Kumar
5. Data Structures with C++: Schaum's Outlines by Hubbard JohnBressard,
6. Horowitz/Sahani, Fundamental of Algorithm. PHI, Galgotia.
7. Magnifying Data Structures, Arpita Gopal, PHI Publications