SCHEME OF COURSE WORK

Department of Information Technology

Course Details:

Course Title	***Advanced Data Structures and Algorithms***
Course Code	**: *15IT2104***
Program:	**: M.TECH**
Specialization:	**Software Engineering**
Semester	**: I**
Prerequisites	**: Computer Programming through C, Data Structures, Design and Analysis of Algorithms**

Courses to which it is a prerequisite: Computer Networks. Data Mining,Data Base Management Systems.

Course Outcomes (COs):

CO No.	**Course outcomes**
CO1	Use Abstract Data types.
CO2	Implement Priority Queues and Sorting Algorithms
CO3	Discover solutions for graph problems.
CO4	Devise solutions using algorithm design techniques
CO5	Implement advanced data structures.

Course Outcome versus **Program Outcomes:**

Course outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	S	S	S	S	M	M	M				S
CO2	S	S	S	S	M	M	M				
CO3	S	S	S	S	M	M	M				
CO4	S	S	S	S	M	M					
CO5	S	S	S	S	M	M	M				

Assessment Methods: Assignment / Quiz / Seminar / Case Study / Mid-Test /

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, Vector and list in the STI, Implementation of vector, Implementation of list	CO-1	Compare and contrast between vector and a list.	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 7-8) Mid-Test 1 (Week 9)
2	The Stack ADT, The Queue ADT. Trees: The Search Tree ADT – Binary Search Trees	CO-1	Give the real time applications of stack .	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 1 (Week 9)
3	AVI. Trees, Splay Trees, B-Trees	CO-2	Demonstrate the operations of splay trees and its implementation	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 9)
4	Hashing: General idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing.	CO-1	Explain different techniques in hashing and discuss their limitations.	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 7-8) Mid-Test 1 (Week 9)
5	**Priority Queues:** Implementations, Binary Heap, Applications of Priority Queues, *d*-Heaps, Leftist Heaps	CO-2	Give the applications of priority queues.	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 7-8) Mid-Test 1 (Week 9)
6	Skew Heaps, Binomial Queues. **Sorting:** Sorting: A Lower Bound for Simple sorting Algorithms	CO-2,CO-5	Explain the organization of data in binomial queues	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 1 (Week 9)
7	Shellsort, Heapsort, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for sorting, Bucket Sort, External Sorting.	CO-2	Compare the complexities of merge and quick sort .	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 1 (Week 9) Assignment (Week 7-8)
8	**The Disjoint Set Class:** Equivalence Relations, The Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms	CO-1,CO-3, CO-4	Explain different Smart union algorithms with an example	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 1 (Week 9)
9	**Mid-Test 1**				
10	Path Compression, Worst Case of Union-by-Rank and Path Compression, An Application. **Graph Algorithms:** Definitions, Topological sort	CO-1, CO2,CO-3 ,CO-4	Explain how path compression takes place and what is the need of path compression	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 2 (Week 18)
11	Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, introduction to NP-Completeness.	CO-2,CO-3	Give the algorithm for prims algorithm and discuss its complexity	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 15-17) Mid-Test 2 (Week 18)
12	**Algorithm Design Techniques:** Greedy Algorithms, Divide and Conquer	CO-4	Give the optimal solution for knapsack problem using greedy method	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 2 (Week 18)
13	Dynamic Programming, Randomized Algorithms, Backtracking Algorithms	CO-4	Explain the mechanism in backtracking algorithms	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 2 (Week 18)
14	**Amortized Analysis:** An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.	CO-5	What are skew heaps.	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 15-17) Mid-Test 2 (Week 18)
15	**Advanced Data Structures and**	CO-5	Give the characteristics of red	▫ Lecture / Discussion	Mid-Test 2

	Implementation: Top-Down Splay Trees, Red-Black Trees		black trees	▫ Problem solving	(Week 18)
16	Deterministic Skip lists, AA-Trees	CO-5	Explain the advantages of skip lists	▫ Lecture / Discussion ▫ Problem solving	Assignment (Week 15-17) Mid-Test 2 (Week 18)
17	Treaps, *k*-d Trees, Pairing Heaps	CO-5	What treaps and design an algorithm for implementing operations of treaps.	▫ Lecture / Discussion ▫ Problem solving	Mid-Test 2 (Week 18)
18	**Mid-Test 2**				
19/20	**END EXAM**				