

SCHEME OF COURSE WORK

Course Details:

Course Title	: Data Structures and Algorithms		
Course Code	: 13CS2101	L P C	4 0 3
Programme:	: M.Tech.		
Specialization:	: CSE		
Semester	: Ist Semester		
Prerequisites	: Graph Theory, Design and Analysis of Algorithms , C		
Courses to which it is a prerequisite	: Computer Networks, Data Mining, DBMS		

Course Outcomes (COs):

1	Use the appropriate abstract data type for formulating solutions for the given problem.
2	Describe priority queues using heaps and compare the complexities of various sorting algorithms
3	Examine the solution for dynamic equivalence problem using find and smart union algorithms and discover solutions for various graph problems.
4	Extrapolate various algorithm design techniques with examples and compute amortized analysis for skew heaps, binomial queues, splay trees.
5	Apply various advanced data structures like red-black trees, heap, AA trees, k-d trees etc in relevant application needed.

Program Outcomes (POs):

A graduate of M.Tech CSE Specialization will be able to

1	Graduates will demonstrate knowledge in core subjects of Computer Science and Engineering and the ability to learn independently.
2	Graduates will demonstrate the ability to design a software application or process that meets desired Specifications within the constraints.
3	Graduates will demonstrate the ability to solve problems relevant to industries and research organizations.
4	Graduates will develop innovative thinking capabilities to promote research in core and trans-disciplinary areas.
5	Graduates will be familiar with modern engineering software tools and equipment to analyze computer science and engineering problems.
6	Graduates will demonstrate the ability to collaborate with engineers of other disciplines and work on projects requiring multidisciplinary skills.
7	Graduates will acquire project management and finance control abilities.
8	Graduates will be able to communicate effectively in both verbal and written forms.
9	Graduates will engage themselves in lifelong learning in the context of rapid technological changes in computer science and engineering

10	Graduates will demonstrate an appreciation of ethical and social responsibilities in professional and societal context.
11	Graduates will demonstrate the ability in carrying out tasks independently and by reflective learning.

Course Outcome versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	S	S	S	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				

S - Strongly correlated, *M* - Moderately correlated, *Blank* - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam
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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 STL, Implementation of vector, Implementation of list	CO-1	Compare and contrast between vector and a list.	<ul style="list-style-type: none"> ▫ 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 .	<ul style="list-style-type: none"> ▫ Lecture / Discussion ▫ Problem solving 	Mid-Test 1 (Week 9)
3	AVL Trees, Splay Trees, B-Trees	CO-2	Demonstrate the operations of	<ul style="list-style-type: none"> ▫ Lecture 	Mid-Test 1
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.	<ul style="list-style-type: none"> ▫ Lecture / Discussion ▫ Problem solving 	Assignment (Week 7-8) Mid-Test 1 (Week 9)
5	Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, α -Heaps, Leftist Heaps	CO-2	Give the applications of priority queues.	<ul style="list-style-type: none"> ▫ 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	<ul style="list-style-type: none"> ▫ 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 .	<ul style="list-style-type: none"> ▫ 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	<ul style="list-style-type: none"> ▫ 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	Explain how path compression takes place and what is the need	<ul style="list-style-type: none"> ▫ 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 Prim's algorithm and discuss its complexity	<ul style="list-style-type: none"> ▫ 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	<ul style="list-style-type: none"> ▫ Lecture / Discussion ▫ Problem solving 	Mid-Test 2 (Week 18)
13	Dynamic Programming, Randomized Algorithms, Backtracking Algorithms	CO-4	Explain the mechanism in backtracking algorithms	<ul style="list-style-type: none"> ▫ 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.	<ul style="list-style-type: none"> ▫ Lecture / Discussion ▫ Problem solving 	Assignment (Week 15-17) Mid-Test 2 (Week 18)
15	Data Structures and Algorithms	CO-5	Give the characteristics of red-black trees	<ul style="list-style-type: none"> ▫ Lecture / Discussion 	Mid-Test 2

Faculty Member