SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Information Technology	
~~B.E~~/B.Tech/~~M.E/M.Tech~~ : Information Technology Regulation:2022 PG Specialisation : NA Sub. Code / Sub. Name : IT22408- Paradigms of Algorithm Design: Theory and Practices Unit : I	LP: Sub Code Rev. No: 00 Date:

Unit Syllabus: **INTRODUCTION** **6+6**

Overview of Algorithms - Definition, characteristics, and types, real-world applications - Algorithm Analysis Basics - Time and space complexity - Asymptotic notations (Big O, Omega, Theta). Brute Force Algorithms - Exhaustive search techniques - Examples and applications

Suggested Activity (not limited to)

Implement on various input sizes (n) and plot a graph for n Vs time taken

1. Problems on linear and quadratic time complexities ex: Linear Search, matrix operations
2. Selection Sort
3. Insertion Sort
4. Bubble Sort

Objective: To analyze the algorithms for time/space complexity.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Overview of Algorithms – Definition, Characteristics	T-2.Ch-1,Pg.No:21-24	LCD/BB
2	Time and Space complexity	T-2.Ch-1,Pg.No:21-24	LCD/BB
3	Asymptotic Notations(Big O,Omega and Theta)	T-2.Ch-1,Pg.No:24-30	LCD/BB
4	Algorithm Analysis Basics	T-2.Ch-1,Pg.No:21-24	LCD/BB
5	Algorithm Analysis Basics	T-2.Ch-1,Pg.No:21-24	LCD/BB
6	Exhaustive Search Techniques - Brute Force approach	Ref.2 Ch-7,Pg.No-231-232	LCD/BB
7	Examples and Applications – Substring in a given string	Ref.2 Ch16,Pg.No:459-460	LCD/BB/ Experiential Learning
8	Linear search, Binary Search	Ref.2 Ch-7,Pg.No-232-236	Experiential Learning
9	Selection Sort, Bubble Sort	Ref.2 Ch-7,Pg.No-236-245	Experiential Learning
10	Insertion Sort	Ref.2 Ch-7,Pg.No-236-245	Experiential Learning
11	Matrix operations	1.Ch4,Pg.No:76-77	Experiential Learning
12	Prime number check using various methods	Analysis of Different Methods to find Prime Number in Python - GeeksforGeeks	Experiential Learning

Content beyond syllabus covered (if any):

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Sub. Code / Sub. Name: IT22408- Paradigms of Algorithm Design: Theory and Practices

Unit : **II**

Unit Syllabus: **Recursion and Backtracking** **6+6**

Recursive Functions-Recursion and Memory, Recursion vs Iteration, Recurrence Relation. Backtracking-Strategy, problems.

Suggested Activity (not limited to) Implement on various input sizes (n) and plot a graph for n Vs time taken

1. Checking for ascending order of array 2. Reversing a singly linked list 3. Heap sort.
4. kth smallest/largest element in Binary Search Tree 5. N-Queens Problem
6. Sum of Subsets

Objective: To learn to write algorithms for a given problem using recursion and backtracking

Session No *	Topics to be covered	Ref	Teaching Aids
13	Recursion Functions - Introduction	T-2.Ch-3,Pg.No:61-68	LCD/BB
14	Memory and recursion	T-2.Ch-3,Pg.No:68-70	LCD/BB
15	Recursion vs Iteration	T-2.Ch-3,Pg.No:68-70	LCD/BB
16	Recurrence Relation	T-2.Ch-3,Pg.No:76-79	LCD/BB
17	Backtracking Strategy	T-2.Ch-3,Pg.No:99-101	LCD/BB
18	Checking ascending order of array	T-2.Ch-3,Pg.No:75-76	LCD/BB
19	Reversing a Singly Linked list	T-2.Ch-3,Pg.No:79-85	LCD/BB/ Experiential Learning
20	Heapsort	T-1.Ch-6,Pg.No:151-162	Experiential Learning
21	Kth smallest /Largest Problem in BST	T-2.Ch-3,Pg.No:79-85	Experiential Learning
22	Hamiltonian Cycle	Ref.2 Ch14,Pg.No:531-534	Experiential Learning
23	N- Queens Problem	Ref.2 Ch14,Pg.No:522-525	Experiential Learning
24	Sum of subsets	Ref.2 Ch14,Pg.No:525-527	Experiential Learning
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

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Sub. Code / Sub. Name: : IT22408- Paradigms of Algorithm Design: Theory and Practices

Unit : **III**

Unit III: Divide & Conquer and Greedy Approaches **6+6**

Divide and Conquer Technique - Strategy -Recurrence equation for divide and conquer- Application. Greedy Algorithm- Strategy, problems

Suggested Activity (not limited to) Implement on various input sizes (n) and plot a graph for n Vs time taken

1. Binary Search 2. Merge Sort 3. Quick Sort 4. Pair wise multiplication of elements (Greedy) 5. Fractional Knapsack Problem (Greedy) 6. Minimal Spanning Tree

Objective: To learn about Divide and Conquer & Greedy design technique and their applications

Session No *	Topics to be covered	Ref	Teaching Aids
25	Divide and Conquer Technique - Strategy	1.Ch15,Pg.No:65-68	LCD/BB
26	Recurrence equation for divide and conquer	1.Ch15,Pg.No:65-68	LCD/BB
27	Application.	1.Ch15,Pg.No:65-68	LCD/BB
28	Greedy Algorithm- Strategy, problems	Ref.2 Ch-11,Pg.No:372-375	LCD/BB
29	Binary Search, Quick sort	Ref.2 Ch- 8,Pg.No:269-275	LCD/BB
30	Merge Sort	Ref.2 Ch- 8,Pg.No:264-269	LCD/BB
31	Min max problem	Ref.2 Ch -8,Pg.No:277-280	LCD/BB/ Experiential Learning
32	Strassen multiplication	Ref.2 Ch- 8,Pg.No:382-384	Experiential Learning
33	Activity selection and SJF	Ref.2 Ch-11,Pg.No:382-384	Experiential Learning
34	Huffman Coding	Ref.2 Ch-11,Pg.No:393-398	Experiential Learning
35	Fractional Knapsack Problem	Ref.2 Ch-11,Pg.No:384-388	Experiential Learning
36	Minimal Spanning Tree	Ref.2 Ch-11,Pg.No:401-407	Experiential Learning

Content beyond syllabus covered (if any):

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Sub. Code / Sub. Name: : IT22408- Paradigms of Algorithm Design: Theory and Practices

Unit : IV

Unit Syllabus: **Dynamic Programming** **6+6**

Introduction to Dynamic Programming - Principles and applications -Memoization and Tabulation - Techniques for optimization - Analysis of DP algorithms- Applications of Dynamic Programming.

Suggested Activity (not limited to) Implement on various input sizes (n) and plot a graph for n Vs time taken

1. Fibonacci sequence 2. Binomial Coefficient 3. Longest Common Subsequence 4. Matrix Chain Multiplication 5. Travelling Salesman problem 6. Hamiltonian cycles 7. 0/1 Knapsack Problem

Objective: To learn about dynamic programming design technique and its applications

Session No *	Topics to be covered	Ref	Teaching Aids
37	Introduction to Dynamic Programming	1.Ch15,Pg.No:357-360	LCD/BB
38	Principles and Applications	1.Ch15,Pg.No:357-360	LCD/BB
39	Memoization and Tabulation Techniques	1.Ch15,Pg.No:357-360	LCD/BB
40	Analysis of DP algorithms	1.Ch15,Pg.No:357-360	LCD/BB
41	Applications	1.Ch15,Pg.No:357-360	LCD/BB
42	Fibonacci sequence	Ref.2 Ch13,Pg.No:460-463	LCD/BB
43	All pairs shortest path	1.Ch15,Pg.No:693-700	LCD/BB/ Experiential Learning
44	Binomial coefficient	Ref.2 Ch13,Pg.No:463-466	Experiential Learning
45	Longest common subsequence	1.Ch15,Pg.No:390-397	Experiential Learning
46	Matrix Chain multiplication	1.Ch15,Pg.No:370-378	Experiential Learning
47	Hamiltonian Cycles	Ref.2 Ch14,Pg.No:531-534	Experiential Learning
48	0/1 Knapsack problem	Ref.2 Ch13,Pg.No:496-500	Experiential Learning

Content beyond syllabus covered (if any):

* Session duration: 50 mins

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Sub. Code / Sub. Name: : IT22408- Paradigms of Algorithm Design: Theory and Practices

Unit : V

Unit Syllabus: **NP Completeness** **6+6**

Understanding of Computational Complexity – Tractable and Intractable Problems - P, NP Hard, NP Complete problems – Bin Packing problem - Reducibility – Approximation algorithms - TSP – Randomized Algorithms - Randomized Quick Sort

Objective: To learn about computational complexity – P,NP problems.

Session No *	Topics to be covered	Ref	Teaching Aids
49	Understanding of Computational Complexity	Ref.2 Ch18,Pg.No:638-647	LCD/BB
50	Tractable and Intractable Problems	Ref 1. Ch 9, Pg. No 346-350	LCD/BB
51	P problems	Ref.2 Ch18,Pg.No:647-648	LCD/BB
52	NP Hard problems	Ref.2 Ch18,Pg.No:647-648	LCD/BB
53	NP Complete Problems	Ref.2 Ch18,Pg.No:648-650	LCD/BB
54	Approximation algorithms	Ref. 1 Ch 9, Pg. No 370	LCD/BB
55	Bin Packing Problem	Ref. 2 Ch 9, Pg. No 374-378	LCD/BB/ Experiential Learning
56	Reducibility	Ref. 1 Ch 9, Pg. No 354-359	Experiential Learning
57	Approximation TSP	Ref.2 Ch18,Pg.No:648-650	Experiential Learning
58	Approximation TSP	Ref.2 Ch18,Pg.No:648-650	Experiential Learning
59	Randomized Quick sort	Ref.2 Ch18,Pg.No:675-678	Experiential Learning
60	Randomized Quick sort	Ref.2 Ch18,Pg.No:675-678	Experiential Learning
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

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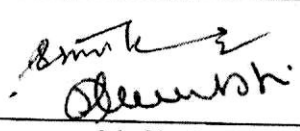
TEXT BOOKS:

1. T T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", PHI Learning Private Limited, 2012,
2. Narasima Karumanchi, "Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer, and Dynamic Programming", CareerMonk Publications, 2018

REFERENCES:

1. Richard E Nepolitan., Foundations of Algorithms, Fifth Edition, Jones and Bartlett Publishers
2. Design and Analysis of Algorithms, S. Sridhar, Oxford Univ.Press,2014

	Prepared by	Approved by
Signature		
Name	Mr.Sivakumar.E, Ms.Meenakshi.P	Dr. V. Vidhya
Designation	Assistant Professor	Professor & HoD
Date	22/01/2024	22/01/2024
Remarks *:		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD

The same lesson plan to be followed for the academic year 2024 - 2025 (Even).

1. [MEENAKSHI.P]

2. (Kavya.R)

HOD/IT.