INSTITUTE	**FACULTY OF COMPUTER APPLICATIONS**
PROGRAM	**MASTER OF SCIENCE (DATA SCIENCE)**
SEMESTER	**1**
COURSE TITLE	**DESIGN AND ANALYSIS OF ALGORITHMS**
COURSE CODE	**05MD0105**
COURSE CREDITS	**5**

Objective:

1 Learn analysis of algorithm by working out for time and space complexity of algorithms, growth of function.

2 Learn different algorithm analysis techniques.

3 Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes: After completion of this course, student will be able to:

1 To analyze worst-case running times of algorithms using asymptotic analysis.

2 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.

3 Able to understand dynamic programming, its elements and analyze existing algorithm of dynamic programming.

4 To understand greedy paradigm and explain when an algorithmic design situation calls for it.

5 5. To understand dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm.

Pre-requisite of course: Data Structure, C

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction** Algorithms, Analysis of Algorithms, Growth of funnction, Asymptotic notations	4
2	**Algorithms using Divide and Conquer** Working of Divide and Conquer, Strassen's algorithm for matrix multiplication, working of Binary Search, Algorithm of Binary Search, working of Merge Sort, Algorithm of Merge Sort, working of Quick Sort, Algorithm of Quick Sort, advantages and disadvantages of Divide and Conquer technique., Test-1	10

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Contents : Unit	Topics	Contact Hours
3	**Greedy Algorithms** Characteristics of Greedy Algorithm, Difference between D & C and Greedy algorithm, working of Activity selection problem, Algorithm of Activity selection problem, working of Knapsack Problem, Algorithm of Knapsack Problem, working of Job sequencing with deadline. , Algorithm of Job sequencing with deadline. , advantages of greedy algorithm, test-2	10
4	**Minimum Spanning Trees and Single-Source Shortest Paths:** Introduction of Minimum Spanning Trees, working of Prim's algorithm, example of Prims algorithm, Find Shortest path using Dijkstra's algorithm, example of Find Shortest path using Dijkstra's algorithm, practic	6
5	**Dynamic Programming** Elements of Dynamic Programming, road cutting problem , example of road cutting problem solution using dynamic programming, Longest common subsequence problem, example of solving Longest common subsequence poblem using dynamic programming, Matrix chain multiplication, example of solving Matrix chain multiplication problem using dynamic programming, revision , doubt solving, test	10
6	**Backtracking, Branch and Bound Algorithms** What is Backtracking, Branch and Bound Algorithms , Search using BFS, Search using DFS, 8-Queen problem, example to solve 8 -Queen problem, M-Coloring problem, example to solve M-Coloring problem, solve Shortest path problem using brach and bound, solve 8-Puzzle, Limitations of Branch-and-Bound.	10
Total Hours		**50**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**UNIT 1** 1. Write and implement algorithm with complexity analysis for finding prime number from given numbers. , 2. Write and implement algorithm with complexity analysis for finding factorial for given number, 3. Write and implement algorithm with complexity analysis for generating Fibonacci series , 4. Determine smallest divisor of an integer., 5. Find X^n. Iterative and recursive algorithms are possible with complexity analysis, 6. Write and implement algorithm with complexity analysis for print sum of digit for given number , 7. Determine product of 2 integers (a * b) as repeated sums. Iterative and recursive algorithms are possible. , 8. Write a program to find GCD using recursion., 9. Write a program to find LCM of two numbers using recursion., 10. Write a program to reverse an integer number using recursion	10

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	**UNIT 2** 1. Find square root of a number. Can we use Divide & Conquer approach for this problem? , 2. Program for finding maximum number using Divide and conquer., 3. Program for finding minimum number using Divide and conquer, 4. Implement Recursive Binary search. , 5. Sort a given sequence of numbers using Merge Sort, 6. Sort a given sequence of numbers using Quick Sort., 7. Write a program for matrix multiplication, 8. Implement Strassen's algorithm for matrix multiplication .	8
3	**UNIT 3** 1. Implement Knapsack problem using Greedy method. , 2. Implement Job sequencing problem using Greedy method., 3. Implement activity selection problem using Greedy method.	3
4	**UNIT-4** 1. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm , 2. Prim's algorithm to find minimum cost tree (shortest path in a tree). , Kruskal's algorithm to find minimum cost tree (shortest path in a tree).	3
5	**UNIT 5** 1. Write a program for Matrix chain multiplication using Dynamic Programming method. , 2. Write a program for solution of Rod-cutting problem using Dynamic Programming method., 3. Write a program to find Longest Common Subsequence using Dynamic Programming method	3
6	**UNIT 6** 1. Breadth First Search (BFS) in a binary tree. , 2. Depth First Search (DFS) in a binary tree. , 3. Write a program for M-coloring problem., 4. Write a program for 8-queen problem.	4
Total Hours		**31**

Textbook :

1 Introduction to Algorithms, Cormen, Thomas,Charles Leiserson, et al., MIT Press, 3rd ed, 2009

2 Design and Analysis of Algorithms, Parag H Dave, Himanshu B Dave, Pearson, 2014

References:

1 Fundamentals of Computer Algorithms, Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press, 2008

2 Introduction to Design and Analysis of Algorithms, Introduction to Design and Analysis of Algorithms, Anany Levitin, Pearson, 2014

3 Fundamental of Algorithms by Gills Brassard, Fundamental of Algorithms by Gills Brassard, Paul Bratley, PHI, .

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Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking**
10.00	10.00	30.00	20.00	20.00	10.00

Instructional Method:

1 Board Work
2 PPT
3 Videos

Supplementary Resources:

1 https://www.javatpoint.com/daa-tutorial
2 https://www.coursera.org/specializations/data-structures-algorithms
3 https://www.geeksforgeeks.org/openmp-introduction-with-installation-guide/
4 https://swayam.gov.in/nd1_noc19_cs47/preview

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