INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (COMPUTER ENGINEERING)**
SEMESTER	**5**
COURSE TITLE	**DESIGN AND ANALYSIS OF ALGORITHM**
COURSE CODE	**01CE1503**
COURSE CREDITS	**4**

Objective:

1 This course provides students with a thorough understanding of algorithm design, analysis, and optimization techniques. Students will be able to develop the ability to analyse the time and space complexity of algorithms using asymptotic notation, recurrence relations, and other mathematical tools. Students will be able to understand the basic data structures, algorithmic techniques, and design paradigms, including greedy algorithms, dynamic programming, divide and conquer.

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

1 Analyse the complexity of algorithms and evaluate their performance in terms of time and space requirements.

2 Implement various algorithms using the Divide and Conquer approach.

3 Design an optimal solution by applying various methods like Dynamic Programming and the Greedy Method.

4 Evaluate various Graph Matching and Pattern Matching Algorithms.

5 Apply backtracking and branch-and-bound techniques to solve problems, and interpret NP-Complete and NP-Hard concepts in algorithm analysis.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Analysis of Algorithm:** Introduction to algorithm, characteristics,, Efficiency of algorithm, Average, Best and Worst case analysis,, Asymptotic notations – Big oh notation, Omega notations, , Theta notation , Amortized Analysis, Analysis of algorithms – Using control statements,, through recurrence equation- Substitution method, , Master's method, Tree based method.	8

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Contents : Unit	Topics	Contact Hours
2	**Sorting and Divide and Conquer Approach:** Comparison based sorting algorithms, , Non Comparison based sorting algorithms,, Problem Solving using divide and conquer algorithm-Max-Min problem, , Matrix Multiplication, , Exponential.	8
3	**Greedy and Dynamic Programming:** Introduction to Greedy algorithm,, Characteristics, , elements of greedy technique, Activity selection problem, Knapsack problem, Job Scheduling problem., Introduction to Dynamic programming, , elements of dynamic programming, Greedy vs. Dynamic,, Making, Change, Knapsack problem, Assembly Line Scheduling, Matrix Chain Multiplication, Longest Common Subsequence, Huffman coding.	12
4	**Graph Representation and String Matching:** Graph Traversal algorithms- Breadth First Search, Depth First Search, , Minimum Spanning Tree- Prim's and Kruskal's Algorithm, Shortest Path Algorithm – Dijkstra's Algorithm, All Pair Shortest Path, Bellman-Ford Algorithm. Introduction to String Matching,, The naive string matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.	8
5	**Backtracking, Branch and Bound, NP Completeness:** Introduction, The Eight Queens problem, Knapsack problem, Travelling Salesman problem,, Minimax principle. The class P and NP,, Polynomial reduction, 2-CNF Satisfiability, 3- CNF Satisfiability, NP- Completeness Problem, , NP-Hard Problems, Travelling Salesman problem, Hamiltonian problem.	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Practical – 1** Time Analysis using Control Structure	2
2	**Practical – 2** Sorting Techniques-I	2
3	**Practical – 3** Sorting Techniques-II	2
4	**Practical – 4** Sorting Techniques-III	2
5	**Practical – 5** Greedy Programming- I	2
6	**Practical – 6** Greedy Programming- II	2
7	**Practical – 7** Dynamic Programming- II	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
8	**Practical – 8** Dynamic Programming- II	2
9	**Practical – 9** Dynamic Programming- III	2
10	**Practical – 10** Dynamic Programming- IV	2
11	**Practical – 11** Graph Matching-I	2
12	**Practical – 12** Graph Matching-II	2
13	**Practical – 13** String Matching	2
14	**Practical – 14** NP Completeness	2
Total Hours		**28**

Textbook :

1 Fundamental of Algorithms, Brassard, Gilles, and Paul Bratley, Prentice Hall of India, , 1996

References:

1 Introduction to Algorithms, Introduction to Algorithms, Cormen, Thomas H., et al. , MIT Press, 2022

2 Fundamentals of Computer Algorithms. , Fundamentals of Computer Algorithms. , Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Silicon Press, 2008

3 Introduction to Design and Analysis of Algorithms. , Introduction to Design and Analysis of Algorithms. , Anany Levitin ·, Pearson, 2018

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					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	25.00	25.00	20.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

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Instructional Method:

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html

2 http://nptel.ac.in/courses/106101060/

3 http://www.comp.nus.edu.sg/~cs5234/Links/Course-Links.htm

4 https://www.coursera.org/learn/algorithm-design-analysis

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