



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

ALGORITHM DESIGN AND ANALYSIS								
IV Semester: CSD / CSE / CSM								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2540511	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Programming for problem solving, Data Structures								

Course Overview:

The course **Algorithms Design and Analysis (ADA)** focuses on the systematic development and evaluation of algorithms for solving computational problems efficiently. It introduces fundamental algorithmic techniques and provides a strong foundation for analysing algorithm performance in terms of time and space complexity. The course emphasizes both theoretical understanding and practical problem-solving

Course Objectives:

1. Develop proficiency in evaluating algorithms using asymptotic notations, including best-, average-, and worst-case time/space complexities, and solving related recurrence relations.
2. Master various algorithmic strategies—divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound—identifying suitable use cases and demonstrating their application.
3. Critically assess and contrast different algorithms in terms of efficiency, scalability, and correctness through rigorous analytical reasoning and empirical evaluation.
4. Differentiate between tractable (polynomial-time) and intractable (super-polynomial or exponential-time) problems;
5. Identify and classify problems as P, NP, NP-hard, or NP-complete, and assess their relationships through polynomial-time reductions and Cook's theorem.

Course Outcomes: After Completion of the Course, Students should be able to:

1. Understand algorithmic concepts, performance analysis techniques, complexity measures, and asymptotic notations.
2. Apply divide and conquer strategies, disjoint set operations, heap-based structures, and backtracking techniques for problem solving.
3. Analyze dynamic programming approaches and algorithmic solutions for optimization problems.
4. Examine greedy algorithms, graph traversal techniques, shortest path methods, and spanning tree constructions.
5. Evaluate branch and bound strategies, computational complexity classes, NP-hard and NP-complete problem characteristics.

UNIT - I

Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation, and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

UNIT - II

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heapsort

Backtracking: General method, applications, n-queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT - III

Dynamic Programming: General method, applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT - IV

Greedy method: General method, applications- Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Bi-connected components.

UNIT - V

Branch and Bound: General method, applications - Travelling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

TEXT BOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni, and Rajasekaran, University Press.

REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman, and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and Sons.

ELECTRONIC RESOURCES:

1. <https://www.classcentral.com/course/youtube-design-and-analysis-of-algorithms>
2. <https://www.codechef.com/learn/course/college-design-analysis-algorithms>
3. <https://ocw.iti.hr/courses/electrical-engineering-and-computer-science/>
4. <https://www.nesoacademy.org/cs/16-design&analysisofalgorithms>

MATERIALS ONLINE:

1. PDF set of lecture notes
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Course Materials
5. Question banks and solved examples
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)