

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ADVANCED ALGORITHMS								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSD13	Core	L	Т	Р	С	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 48	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 48		
Prerequisites: Advanced Data Structures								

I. COURSE OVERVIEW:

This course typically aims to equip students with a deep understanding of fundamental algorithmic techniques, their analysis, and their applications in solving complex computational problems. This course includes graph theory, flow networks, and linear programming. Gain an understanding of a wide range of advanced algorithmic problems, and their application to real-world problems.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. The advanced methods of designing and analyzing algorithms.
- II. The student should be able to choose appropriate algorithms and use it for a specific problem.
- III. Students should be able to understand different classes of problems concerning their computation difficulties.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- CO1 Analyze algorithm efficiency, including time complexity, and space complexity for problem solving techniques
- CO2 Determine the appropriate data structure for solving a particular set of problems
- CO3 Develop algorithms using advanced techniques such as graph algorithms, and flow algorithms
- CO4 Apply substitution, recurrence-tree methods to solve recurrences
- CO5 Gain an understanding of a wide range of advanced algorithmics, and their application to realworld problems
- CO6 Explore the complexity theory, and the concept of NP-completeness, and be able to identify and classify problems within different complexity classes

IV.COURSE CONTENT:

MODULE-I: Role of algorithms in computing (10)

Role of algorithms in computing, Analyzing algorithms, Designing Algorithms,

Growth of Functions, Divide and Conquer- The maximum-subarray problem, Strassen's algorithms for matrix multiplication, The substitution method for solving recurrences, The recurrence-tree method for solving recurrence, The master method for solving recursions, Probabilistic analysis, and random analysis

MODULE-II: Review of Data Structures (10)

Review of Data Structures- Elementary Data Structures, Hash Tables, Binary Search Trees, and Red-Black Trees.

MODULE-III: Elements of dynamic programming (09)

Elements of dynamic programming, - Matrix-chain multiplication, Longest common subsequence, Greedy Algorithms - Elements of the greedy strategy, Huffman codes, Amortized Analysis - Aggregate analysis, The accounting method, The potential method, Dynamic tables.

MODULE-IV: Flow – Networks (10)

Flow-Networks: Maxflow-min-cut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

MODULE-V: Shortest Path in Graphs (09)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Linear Programming: Geometry of the feasibility region and Simplex algorithm

NP-completeness: Examples, proof of NP-hardness and NP-completeness.

V. TEXTBOOKS

- 1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms". The MIT Press, 4th edition, 2022.
- 2. Aho, Hopcroft, Ullman "The Design and Analysis of Computer Algorithms", Pearson Education, 7th edition, 2018.

VI. REFERENCE BOOKS:

1. Kleinberg and Tardos "Algorithm Design", Pearson Education, 2nd edition, 2016.

VII. WEB REFERENCES:

- 1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
- 2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
- 3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

VIII.E-TEXTBOOKS:

- 1. https://mitpress.mit.edu/9780262530910/
- 2. https://edutechlearners.com/download/Introduction_to_algorithms-3rd%20Edition.pdf
- 3. https://books.google.co.in/books/about/Introduction_To_Algorithms.html?id=NLngYyWFl_YC &redir_esc=y