

Design and Analysis of Algorithms

Semester I

Subject Code: MS11902

Learning Outcomes:

After completion of this subject, the student shall be able to:

- Understand Basic Algorithm Analysis techniques and the use asymptotic notation
- Understand the use of data structures in improving algorithm performance
- The use of different paradigms of problem solving will be used to illustrate clever and efficient ways to solve a given problem
- Apply the algorithms and design techniques to solve problems
- Analyze the complexities of various problems in different domains



Design and Analysis of Algorithms

Semester I	Subject Code: MS11902	Lectures: 60
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Objectives:

- The syllabus aims in equipping students with,
- Basic Algorithm Analysis techniques and understand the use of asymptotic notation
 - Understand different design strategies
 - Understand the use of data structures in improving algorithm performance
 - Understand classical problem and solutions
 - Learn a variety of useful algorithms
 - Understand classification of problems

Unit 1: Analysis	6
<ul style="list-style-type: none"> • Algorithm definition, space complexity, time complexity, worst case –best case –average case complexity, asymptotic notation • Sorting algorithms (insertion sort, heap sort), recursive algorithms (Tower of Hanoi , Permutations). 	6

Unit 2: Design strategies	8
<ul style="list-style-type: none"> • Divide and conquer-control abstraction, ternary search, Strassen's matrix (2X2) • Transform and conquer:- Horner's Rule and Binary Exponentiation – Problem Reduction 	4 4

BOS Members:

Prof. Seema Chowhan (Subject Expert)

Prof. M.B. Lonare (Subject Expert)

Ms. Shilpa Khadilkar (Subject Expert)

Ms Anuradha Bhamre (Industry Expert)

Ms Aishwarya Kaliyiluvila (Alumni)

Prof. Ashwini Kulkarni (Chairman)

Prof. Alka Kalhapure (Internal Faculty)

Prof. Swati Pulate (Internal Faculty)



Unit 3: Greedy method	8
<ul style="list-style-type: none"> • Knapsack problem • Job sequencing with deadlines • Minimum-cost spanning trees • Kruskal and Prim's algorithm 	
Unit 4: Dynamic programming	10
<ul style="list-style-type: none"> • Matrix chain multiplication • Single source shortest paths • Bellman- ford algorithm • All pairs shortest path • Longest common subsequence • String editing • 0/1 knapsack problem • Traveling salesperson problem. • Multistage Graphs 	
Unit 5: Backtracking	4
<ul style="list-style-type: none"> • General method • 8 Queen's problem • Sum of subsets problem • Graph coloring problem • Hamiltonian cycle 	
Unit 6: Branch and Bound Technique	4
<ul style="list-style-type: none"> • FIFO, LIFO • LCBB • TSP problem • 0/1 knapsack problem 	
Unit 7: Problem classification	5

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<ul style="list-style-type: none"> • Nondeterministic algorithm • The class of P, NP, NP-hard and NP- Complete problems • Significance of Cook's theorem • NCDP, M-chromatic • Halting Problem 	
Unit 8: Parallel, Concurrent and Distributed Algorithm	3
<ul style="list-style-type: none"> • Parallel Algorithm-Primes • Concurrent Algorithm • Distributed Algorithm-Floyds-Warshall 	

*Contact hours – 12 hours

Reference Books:

1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, *Computer Algorithms*, Galgotia.
2. T. Cormen, C. Leiserson, & R. Rivest, *Algorithms*, MIT Press, 1990
3. A. Aho, J. Hopcroft, & J. Ullman, *The Design and Analysis of Computer Algorithms*, Addison Wesley, 1974
4. Donald Knuth, *The Art of Computer Programming* (3 vols., various editions, 1973-81), Addison Wesley

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