

<b>DESIGN AND ANALYSIS OF ALGORITHMS</b>	
<b>CSE 315</b>	<b>Credits : 4</b>
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

**Prerequisites:**

Some programming skills and a good back ground in discrete mathematics, data structures and probability will be very helpful.

**Course Objectives:**

- Student will understand the basic design concepts (e.g., pseudo code, specifications, top-down design).
- Student will learn the different algorithm design strategies (procedural knowledge).
- Student can acquire the knowledge to solve the complexities of different problems.
- Student will able to choose appropriate design strategies for different problems.

**Course Outcomes:**

By the end of the course, the student will be able to:	
1.	Demonstrate knowledge about basic design concepts (e.g., pseudo code, specifications, top-down design).
2.	Use and explain the algorithms for different design strategies.
3.	Apply the algorithms and design strategies to solve problems.
4.	Analyze the complexities of various problems in different domains.
5.	Categorize the notions of P and NP problems, NP complete and NP-hard problems.

**Mapping of Course Outcomes with Program Outcomes:**

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3							2				1	
	2	3	3							2					
	3	3	3	2						3					
	4	3	3	2	3					1				1	
	5	2	2		2										

**SYLLABUS**

**UNIT-I:**

**12 Periods**

**Introduction :**

Introduction, Steps for algorithmic problem solving , Important Problem Types Analysis framework (Orders of growth, Cases), Asymptotic Notations and Efficiency Classes, Mathematical Analysis for recursive Algorithms and Non-recursive Algorithms, Empirical Analysis, Algorithm Visualization.

**Case Study:** Pseudo code Conventions, Time and Space Complexities

**UNIT-II:****14 Periods****Brute Force:**

Brute Force- Selection and Bubble sort, Sequential Search, String Matching, Closest- Pair, Convex Hull Problems, Exhaustive Search -Travelling Salesman problem, knapsack problem, Assignment Problem.

**Decrease and Conquer:**

Decrease by a constant: Insertion Sort, Algorithms for generating combinatorial problems, Decrease by constant factor algorithms, Variable size decrease.

**Divide-and-Conquer :**

Merge sort, Quick sort, Binary Search, Multiplication of large integers and Strassen's Matrix Multiplication, Closest- Pair, Convex Hull Problems.

**UNIT-III:****12 Periods****Transform and conquer:**

Presorting, Gauss Elimination, Balanced Trees –2-3 Trees, Heap sort, Horner's rule and binary exponentiation, Problem reduction.

**Dynamic Programming:**

Computing a Binomial Coefficient, Warshall's and Floyd's Algorithm, Optimal Binary Search Trees, The Knapsack Problem and Memory Functions.

**UNIT-IV:****12 Periods**

**Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm – Huffman Trees.

**Space And Time Tradeoffs:** Sorting by computing, Input Enhancement in String Matching- Horspool's Algorithm, Boyer-Moore Algorithm, Hashing, B-Trees

**UNIT-V:****14 Periods**

**Limitations of Algorithm Power:** Lower-Bound Arguments, Decision Trees, P, NP and NP complete problems, Challenges of Numerical Algorithms

**Coping with the limitations of Algorithms Power** – Backtracking, Branch-and-Bound  
Case study for Backtracking: Graph Coloring

**NP Problems** - Approximation Algorithms for NP-hard Problems, Algorithms for solving Nonlinear Equations.

**Text Books:**

1. Anany Levitin, "Introduction to Design & Analysis of Algorithms", 2003, Pearson Education, New Delhi.

**Reference Books :**

1. Ellis Horowitz, S. Sahni et.al, "Fundamentals of Computer Algorithms", 2001, Galgotia Pub.
2. Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein, "Introduction to Algorithms" Prentice Hall of India, New Delhi
3. Aho, Hopcroft & Ullman, "The Design and Analysis of computer Algorithms", 2003 Pearson Education, New Delhi
4. Gilles Brassard & Paul Bratley, "Fundamentals of Algorithmic", Prentice Hall of India, New Delhi

**Web Resources:**

1. <http://nptel.ac.in/courses/106101060/>
2. <https://www.edx.org/course/subject/data-analysis-statistics>
3. <https://www.udacity.com/courses/data-science>
4. <https://www.coursera.org/specializations/algorithms>