

## UNIVERSITY OF PETROLEUM & ENERGY STUDIES

2021-22 Batch

	Design and Analysis of Algorithms	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic knowledge Mathematics and data structure				
Co-requisites	--				

### Course Objectives

1. To understand the necessity of the algorithm design.
2. To write the algorithm to solve a problem.
3. To analyze the performance of the algorithm.
4. To implement the algorithm in C/C++.

### Course Outcomes

On completion of this course, the students will be able to

- CO1. Apply mathematical techniques to find the complexity of an algorithm.
- CO2. Analyze algorithms and express asymptotically different case behavior.
- CO3. Demonstrate good principles of algorithm designs.
- CO4. Design appreciate data structures to reduce the complexity of an algorithm.
- CO5. Differentiate among P, NP Hard and NP Complete problems.

### Catalog Description

This course deals with various aspects of designing algorithms and their mathematical characteristics. The broad focus lies on computational complexity, divide-and-conquer approach, dynamic programming, greedy approach and backtracking algorithms. The clear distinction among P, NP Hard and NP Complete problems are covered in detail.

### Course Content

**UNIT I:****Introduction****9 Lecture Hours**

Algorithm, Psuedo code, Performance Analysis- Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical, different algorithm design techniques, recurrence relation, solving methods: substitution, recursion tree, master theorem with numerical.

**UNIT II****Divide And Conquer****6 Lecture Hours**

Binary search, Quick sort: best case & worst case analysis, Merge sort, Strassen's matrix multiplication

**UNIT III:****Greedy Method****6 Lecture Hours**

Activity selection problem, knapsack problem, Minimum cost spanning trees: Prims and kruskal, Single source shortest path problem: Bellman ford, dijkstra's, Huffman codes.

**UNIT IV****DYNAMIC PROGRAMMING****5 Lecture Hours**

Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem, largest common subsequence.

**UNIT V****Sorting In Linear Time****6 Lecture Hours**

Lower Bounds For Sorting, Counting Sort, Radix Sort, bucket sort

Backtracking: N-queen problem, sum of subsets problem

**UNIT VI****Branch and Bound Method And Its Applications****4 Lecture Hours**

Travelling salesman problem

NP-Hard and NP-Complete problem and concepts

**Text Books**

1. Thomas H. Cormen (2009) Introduction to Algorithm (Third Edition), The MIT Press. ISBN: 978-0-262-03384-8
2. John Kleinberg and Eva Tardos (2005), Algorithm Design, ISBN: 0-321-29535-8

**Reference Books**

1. Rajesh K. Shukla (2015) Analysis and Design of Algorithms: A Beginner's Approach, Wiley, ISBN-10: 8126554770
2. S.Sridhar (2014), Design and Analysis of Algorithms 1st Edition, Publisher: Oxford University Press ISBN: 9780198093695, 0198093691

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme:**

Components	Internal	Mid Term	ESE	Total
Weightage (%)	30%	20%	50%	100%

**Relationship between the Course Outcomes (COs), Program Outcomes (POs) and Program Specific Objectives(PSOs)**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	1	2									3	1	
CO2	3	3	2	2									3	1	
CO3	2	2	2	1									3	1	
CO4	2	3	2	1									3	1	
CO5	3	2	1	3									3	1	
Average	2.6	2.6	1.6	1.8									3	1	

1=weak

2= moderate 3=strong