DSE-03 (c): Design and Analysis of Algorithms

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Design and Analysis of Algorithms	4	3	0	1	Class XII	DSE-07

***Learning objectives*:**

1. *Introduces the recurrence relations for analyzing the algorithms.*
2. *Introduces the graphs and their traversals.*
3. *Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.*
4. *Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.*

Learning Outcomes:

1. *Compute the asymptotic time complexity of algorithms*
2. *Prove correctness of algorithms*
3. *Use appropriate algorithm design technique(s) for solving a given problem*
4. *Appreciate the difference between tractable and intractable problems*

UNIT-1 **(10 hours)**

Sorting: Selection. Insertion Sort, Selection Sort, Bubble Sort, Heap sort, Linear Time Sorting, Selection Problem, running time analysis and correctness.

UNIT-II **(10 hours)**

Graphs: Review of graph traversals, graph connectivity, testing bi-partiteness, Directed Acyclic Graphs and Topological Ordering.

UNIT-III **(13 hours)**

Divide and Conquer. Introduction to divide and conquer technique, Merge Sort, Quicksort, Maximum-subarray problem.

Intractability: Decision vs optimization problems, NP as a class of problems, NP-hardness, NP-completeness with examples.

UNIT-IV **(12 hours)**

Greedy and dynamic Algorithms: Introduction to the Greedy algorithm design approach, application to minimum spanning trees, fractional knapsack problem.

Introduction to the Dynamic Programming approach, application to subset sum, integer knapsack problem.

References

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., Stein C., Introduction to Algorithms. 3rd edition. Prentice Hall of India. 2010.
2. Kleinberg, J., Tardos, E. Algorithm Design. 1st edition. Pearson. 2013.

List of Practicals **(30 hours)**

A practical implementation of various algorithmic techniques such as sorting, graphs,greedy and dynamic programming.