CSE 901C TH: Design & Analysis of Algorithms **Credit:4**

Course Outcomes (CO):

i. Understand different complexity measures to analyze the complexity/performance of different algorithms.
ii. Understand advanced techniques such as greedy algorithms, dynamic programming and know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.
iii. Understand and conduct mathematical proofs for computation and algorithms.

Syllabus:

Introduction: What is Algorithm? Algorithm and its specification. Time Complexity: Asymptotic Notation, Standard Notation and Common Functions, Asymptotic Analysis(Best, Worst, Average Case). Different cases of Time Complexity of Binary Search and Linear Search, Bubble Sort, Quick Sort, Merge Sort, Tournament Sort, Bucket Sort or Radix Sort, Insertion Sort, Selection Sort.
Greedy Algorithm: Activity Selection Problem, Elements of the Greedy Policy, Hoffman Coding, Task Scheduling Problem, Coin Changing Problem/Algorithm, Prim's Algorithm And Kruskal's Algorithm And Comparisons. Knapsack Problem. Scheduling with Minimizing Time in the System.
Shortest Path Algorithm: Dijkstra Algorithm,
Divide and Conquer Method: Multiplying large integers. Strassen Matrix Multiplication. **Dynamic Programming:** Elements of Dynamic Programming, Making Change, Knapsack Problem, Shortest Path (Floyd Algorithm), Matrix Chained Multiplication, Assembly Line Scheduling.
Exploring Graphs: Introduction,
Traversing Trees: Pre order, Post order Numbering. DFS, BFS, Acyclic Graphs. **Backtracking:** Knapsack Problem, Eight Queen's Problem
Branch and Bound: Assignment Problem.
Graph Algorithms:Single Source Shortest Path: Bellman Ford Algorithm, Dijkstra Algorithm.
All Pairs Shortest Path: Short Path of Floyd Warshall Algorithm, Johnson's Algorithm. **Computational Complexity:** Introduction to NP completeness, The Classes P and NP, Polynomial Reduction, NP Cook's Therom Complete Problems NP-completeness; Redurndancy. Approximation algorithms; Randomized algorithms; Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations),

References:

1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms (2nd edition). MIT Press/ McGraw-Hill
2. Michael T. Goodrich and Roberto Tamassia. Algorithm Design: Foundations, Analysis, and InternetExamples. John Wiley & Sons
3. J. Kleinberg and É. Tardos. Algorithm Design. Addison-Wesley, 2005
4. Hovwitt and Sahani, " Fundamental of Algorithm.