Subject Name: Design & Analysis of Algorithms					
Paper Code: CSEN 2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Module I

1. Algorithm Analysis (3 Lectures) (1st Class Test)

Time and space complexity. Asymptotic Notations and their significance. Asymptotic Analysis. Finding time complexity of well known algorithms like-insertion sort, heapsort, Asymptotic solution to recurrences, Master Theorem.

2. Divide-and-Conquer Method. (3 **Lectures) (1st Class Test)**

Basic Principle, Binary Search – Worst-case and Average Case Analysis, Merge Sort – Time Complexity Analysis, quicksort – Worst-case and Average Case Analysis, Concept of Randomized Quicksort.

3. **Medians and Order Statistics. (3 Lectures) (1st Class Test)**

4. Lower Bound Theory (1 Lecture) (1st Class Test)

Bounds on sorting and searching techniques.

Module II

5. Dynamic Programming (5 Lectures) (1st Class Test)

Basic method, use, Examples: Matrix-chain multiplication, ***All pair shortest paths***, LCS Problem. Optimal Binary Search Trees: Algorithm and speedup using quadrangle inequality.

6. Greedy Method (5 Lectures) (1st Class Test)

Elements of the greedy strategy. Huffman codes. Matroids and the greedy methods. Minimum cost spanning trees: Prim's and Kruskal's algorithms and their correctness proofs.

Module III

7. Amortized Analysis (2 Lectures) (1st Class Test)

Aggregate, Accounting and Potential methods.

8. String matching algorithms: (3 lectures) (2nd Class Test)
Different techniques – Naive algorithm , string matching using finite automata , and Knuth , Morris , Pratt (KMP) algorithm with their complexities .

9. Graphs Algorithms (5 Lectures) (2nd Class Test)

Topological Sorting. Strongly Connected Components. Shortest Path Algorithms: Dijkstra's and Bellman Ford with correctness proofs. (***All pair shortest paths)***

Module IV

10. Disjoint Set Manipulation (2 Lectures) (2nd Class Test)

UNION-FIND with union by rank, Path compression.

11. Network Flow: (2 lectures) (2nd Class Test)
Ford Fulkerson algorithm, Max - Flow Min - Cut theorem (Statement and Illustration)

12. NP-completeness (3 Lectures) (2nd Class Test)

P class, NP-hard class, NP-complete class. Relative hardness of problems and polynomial time reductions. Satisfiability problem, Vertex Cover Problem, Independent Sets, Clique Decision Problem.

13. Approximation algorithms (3 Lectures) (2nd Class Test)

Necessity of approximation scheme, performance guarantee. Approximation algorithms for 0/1 knapsack, vertex cover, TSP. Polynomial time approximation schemes: 0/1 knapsack problem.

TEXTBOOKS:
1. Introduction To Algorithms by Cormen, Leiserson, Rivest and Stein. Third Edition, 2009. Prentice Hall.

2. Algorithm Design by Jon Kleinberg and Eva Tardos. Addison Wesley, 2005.

REFERENCE:

3. Computer Algorithms: Introduction to Design and Analysis by Sarah Basee and Allen van Gelder. 3rd Edition, Addison Wesley.