Course Type	Course Code	Name	L	T	P	Credits
DC	NCSC501	**ADVANCED DATA STRUCTURES AND ALGORITHMS**	3	0	0	3

Course Objective

To provide knowledge of advanced level computer algorithms with considerable depth, analysis and their applications. This course will also provide a strong foundation for research in many areas of computer science.

Learning Outcomes

- To impart knowledge of advanced algorithms
- To familiar with some advanced data structures
- To know the application areas of such algorithms and data structures

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Amortized Analysis: Aggregate Analysis, Accounting Method And Potential Method.	3	To understand how to analyze algorithms using advanced techniques with some examples.
2	Dynamic Programming: Assembly Line Scheduling, Matrix Chain Multiplication.	3	To understand how to design algorithms using dynamic Programming for specific applications.
3	Graph Algorithms: Topological Sorting, Strongly Connected Component, Single Source Shortest Paths in DAG, Johnson's Algorithm. Flow networks: The Ford-Fulkerson method.	7	To familiar with advanced level graph algorithms with their applications.
4	Computational Geometric Algorithms: Geometric Searching Algorithms, Segment Intersection Problems.	3	To familiar with some geometric algorithms and their real applications.
5	Polynomials and FFT: Representation, DFT, FFT (Recursive & Iterative).	3	To impart knowledge about DFT computation and FFT.
6	String Matching Algorithms: Naïve Approach, Finite Automata Approach, Rabin-Karp And Knuth-Morris-Pratt Algorithm.	5	To understand the design of designing various string matching algorithms.
7	Matrix Algorithms: LU Decomposition, LUP Decomposition, Linear System of Equations Solver.	3	To learn how to use matrix methods to solve linear system of equations and how to obtain the inverse of a high dimensional matrix.
8	Approximation Algorithms: Vertex Cover Problem, Travelling Salesman Problem, Set Cover.	2	To understand how to develop approximation algorithms for some NP complete/NP hard problems.
9	Randomized Algorithms: Randomized Quicksort, Minimum Cost Spanning Tree.	2	To familiar with the design of some specific randomized and parallel algorithms.
10	Mesh and Hypercube Algorithms: Broadcasting, Prefix computation, Data Concentration and Sorting algorithms	3	To familiar with algorithm design on parallel computers.
11	Advanced Data Structures: kd-Tree, Binomial and Fibonacci Heaps., Range Trees and their Applications.	8	To learn how to represent and design algorithms for various operations on these advanced level data structures.
	Total	**42**	

Text Books:

1. Cormen, Leiserson, Rivest and Stein, *Introduction to Algorithms,* Prentice Hall of India, 3rd Edition, 2010

Reference Books:

1. Mark De Berg et al., *Computational geometry: Algorithms and Application*, 3rd edition, Springer, 2008.
2. E. Horowitz, S. Sahni, and S. Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press.