NIRMA UNIVERSITY

Institute of Technology

M Tech Computer Science and Engineering (Data Science)

Semester – I

L	T	P	C
3	0	2	4

Course Code	6CS201
Course Title	Complexity Theory and Algorithms

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. comprehend time & space complexity and formal aspects of algorithms
2. identify appropriate data structures and methodologies for efficient algorithm design
3. design and implement efficient algorithms using various approaches

Syllabus:	**Teaching Hours:**
Unit I	**6**
Mathematical Preliminaries of computational complexity: Asymptotic Notations, Proof of correctness, Performance analysis, Recursive Algorithms and Recurrences	
Unit II	**8**
Complexity Theory: Various complexity classes, linear reductions. Probabilistic algorithms, Approximation algorithms and complexity classes relating to Parallel algorithms	
Unit III	**6**
Data Structures: Hash tables, Binomial heaps , Fibonacci heaps, Disjoint set structures	
Unit IV	**12**
Greedy Algorithms: Making change, graphs and minimum spanning tree, Shortest path, Knapsack problem, Scheduling, etc.	
Divide and Conquer: General Template, Various algorithm implementation like Binary search, Merge Sort, Quick Sort, Convex Hull, Matrix multiplication, etc.	
Unit V	**6**
Dynamic Programming: Introduction of Dynamic Programming, Principle of Optimality, Examples like Single source shortest paths, Knapsack problem, Chained matrix multiplication, Longest Common Subsequence, etc.	
Unit VI	**7**
Graph Algorithms: Elementary algorithms, DFS, BFS, Backtracking, and Branch & Bound techniques with related examples	

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings^:

1. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, PHI Publication.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest& Clifford Stein, Introduction to Algorithms, PHI Publication.
3. Ellis Horowitz, SartajSahni,SanguthevarRajasekaran, Fundamentals of Computer Algorithms, University Press
4. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill
5. Robert L. Kruse, Data Structures and Program Design in C, PHI

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list