NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	Integrated B.Tech.(CSE)-MBA
Course Code:	CSI0602
Course Title:	Design and Analysis of Algorithms
Course Type:	Core
Year of Introduction:	2021-22

Credit Scheme

L	T	Practical Component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLO):

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

1. illustrate the notion of algorithmic complexity and logic of fundamental algorithms
2. apply fundamental algorithms in real life problem solving
3. identify and evaluate suitable data structures to solve a problem effectively and efficiently
4. build formal illustration of algorithmic complexity

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	**Elementary Algorithmics:** Efficiency of Algorithms, Average & worst-case analysis, Elementary Operation	02
Unit-II	**Analysis Techniques:** Empirical, mathematical, Asymptotic analysis and related unconditional and conditional notations**.**	03
Unit-III	**Analysis of Algorithms:** Analyzing control structures: sequencing, "For" loops, Recursive calls, "While" and "repeat" loops, Amortized analysis	03
Unit-IV	**Solving Recurrences:** Intelligent guesswork, Homogeneous recurrences, Inhomogeneous Recurrences, Change of variable, Range transformations, Master Theorem, Recurrence Tree	04
Unit-V	**Data Structures:** Heaps, Binomial heaps, Fibonacci heaps, Disjoint set structures	03
Unit-VI	**Greedy Algorithms:** Graphs: Minimum spanning trees-Kruskal's algorithm, Prim's algorithm, Graphs: Shortest paths	04
Unit-VII	**Divide-and-Conquer:** Multiplying large integers, Binary search, sorting: sorting by merging, quick sort, finding the median, Matrix multiplication, Exponentiation, approaches using recursion, memory functions.	04
Unit-VIII	**Dynamic Programming:** The principle of optimality, Various applications using Dynamic Programming.	03
Unit-X	**Branch and Bound, Backtracking**: Design of some classical problems using branch and bound and Backtracking approaches.	02
Unit-X	**Randomized and Approximation Algorithms:** Design of some classical problems**.**	02

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

Suggested Readings/ References:

1. Charles E. Leiserson, Thomas H. Cormen, Ronald L. Rivest, Clifford Stein - Introduction to Algorithms, PHI
2. Gilles Brassard & Paul Bratley, Fundamentals of Algorithmic, PHI.
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekharan, Fundamentals of Computer Algorithms, Galgotia.

Suggested List of Experiments:

Sr. No.	Title	Hours
1	To implement an iterative and full recursive version of following sorting algorithms: Selection Sort, Insertion Sort and Bubble Sort	02
2	To implement Quick Sort algorithm by randomly selecting any element of an array as the pivot element. Display the output after each call to the "PARTITION" function finishes	02
3	To implement merge sort for specified scenarios	02
4	To implement Prim's algorithm	04
5	To implement Binomial Heap and perform all its operations.	04
6	To implement the chained matrix multiplication algorithm using dynamic programming	02
7	To solve the 0/1 Knapsack problem using Branch-and-Bound technique	04

Suggested Case List: -NA-