NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. Computer Science and Engineering
Course Code:	2CSDE84
Course Title:	Probabilistic Algorithms
Course Type:	Departmental Elective
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 importance of probabilistic algorithms with computational models and related complexity classes
2. select appropriate data structures to increase efficiency and effectiveness of a randomized algorithm
3. evaluate complexity of a probabilistic algorithm formally
4. apply various tools and techniques to design probabilistic algorithms for given applications

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**Introduction to Probabilistic Algorithms:** A Min-Cut algorithm, Las Vegas and Monte Carlo algorithms, Binary Planar Partitions, A Probabilistic Recurrence, Computational Model and Complexity Classes	08
Unit-II	**Data Structures:** Random Treaps, Skip Lists, Hash Tables, Hashing with O(1) Search Time	08
Unit-III	**Tools and Techniques:** Game-Theoretic techniques, Moments and Deviations, Tail Inequalities, The Probabilistic Method, Markov Chains, Random Walks, Algebraic Techniques	10
Unit-IV	**Algorithms:** Geometric Algorithms and Linear Programming, Graph Algorithms, Approximate Counting, Parallel and Distributed Algorithms	09
Unit-V	**Applications:** The Online Paging problem, The DNF Counting problem, The Choice Coordination problem, Byzantine Agreement, The k-Server Problem, Primality Testing	10

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. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press
2. Panos M. Pardalos and Sanguthevar Rajasekaran, Advances in Randomized Parallel Computing, Springer
3. J. Hromkovic and I. Zamecnikova, Design and Analysis of Randomized Algorithms, Springer
4. Russ Bubley, Randomized Algorithms: Approximation, Generation and Counting, Springer

Suggested List of Experiments:

Sr. No.	Practical Title	Hours
1	To implement a Min-Cut algorithm.	04
2	To implement randomized algorithm to compute value of pi	02
3	To implement a skip list and all its operations.	02
4	To implement the Simplex algorithm for solving a linear programming problem.	02
5	To implement the parallel version of Quicksort algorithm.	02
6	To implement the algorithm for solving the Online Paging problem.	04
7	To implement the algorithm for solving the DNF Counting problem.	04
8	To implement geometric algorithm	04
9	To implement randomized algorithm for the Convex hull problem	04
10	To implement random treaps along with all the operations	02

Suggested Case List: -NA-