

Course Type	Course Code	Name of Course	L	T	P	Credit
DP (Hons)	NCSH405	<b>RANDOMIZED ALGORITHMS LABORATORY</b>	0	0	3	1.5
<b>Course Objective</b>						
The objective of this lab is to provide hands-on experience in implementing randomized algorithms, analyzing their probabilistic behavior, and understanding their practical applications.						
<b>Learning Outcomes</b>						
Upon successful completion of this lab, students will:						
<ul style="list-style-type: none"> <li>Gain practical knowledge of designing and implementing randomized algorithms.</li> <li>Understand the empirical behavior of different randomized techniques.</li> <li>Learn to analyze and compare randomized vs. deterministic approaches.</li> </ul> Develop proficiency in using randomness for solving computational problems efficiently.						
Unit No.	Topics to be Covered	Practical Hours	Learning Outcome			
1	<b>Introduction to Randomized Algorithms:</b> Introduction to randomness & implementation of random number generators, Randomized quick sort	6	Understanding how to generate randomness using Python (NumPy, Random) or C++			
2	<b>Basic Probability Review:</b> Simulation of probability distributions (Uniform, Gaussian, Binomial, Poisson), Empirical validation of Markov's & Chebyshev's inequalities	6	Understanding probability spaces and expectations, Exploring probabilistic bounds in real-world datasets			
3	<b>Randomized Graph Algorithms:</b> Implementation of Karger's Min-Cut Algorithm, Randomized MST and All-Pairs Shortest Paths	9	Understanding randomness in graph partitioning, Applying randomization to fundamental graph problems			
4	<b>Markov Chains and Random Walks:</b> Random Walk on Graphs & PageRank Algorithm, Randomized Algorithm for 2-SAT	9	Learning about Markov chains and random walks and their connection with randomness			
5	<b>Algebraic Techniques:</b> Randomized Primality Testing (Miller-Rabin Test), Universal Hashing, Perfect Matching in Bipartite Graphs	12	Exploring applications of algebra in randomized algorithms and applications of randomness in algebraic problems			
<b>Total: 42</b>						

**Text Book:**

1. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press.

**Reference Books:**

1. Michael Mitzenmacher and Eli Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press
2. Stasys Jukna, "Extremal Combinatorics With Applications in Computer Science", Springer Nature