SUGGESTIVE READINGS

- J. C., Jones, D. A. And Nesbitt, C. J. (1997): .Actuarial Mathematics, Society Of Actuaries, Itasca, Illinois, U.S.A.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE– 3B:

SIMULATION TECHNIQUES IN STATISTICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Simulation Techniques in Statistics	4	3	0	1	Class XII pass with Mathematics	knowledge of basic statistics

Learning Objectives

The learning objectives include:

- The objective of this course is to introduce the nuances of techniques involved in simulation studies as applicable to modeling of systems.
- The programming implementations will be completed using C/MATLAB/R/Python.

Learning Outcomes

After completing this course, students will possess skills concerning:

- Use of simulation to understand the behavior of real world systems.
- Ability to generate Pseudo-random numbers by the different methods.
- Random variable generation from theoretical distributions.
- Use of Monte Carlo methods and regenerative simulation.
- Ability to develop programs for the purpose of simulation.

SYLLABUS OF DSE- 3B

Theory

UNIT I **(12 Hours)**

Introduction to simulation

Introduction, Systems, Simulation models, Classification of simulation models; Simulation and Monte Carlo Methods, Pseudo-random number generators; Statistical tests of Pseudo-random numbers.

UNIT II (18 Hours)

Generation of random numbers

Random number generation. Random variable generation- Inverse transform method, Composition method, Acceptance-Rejection method. Generating from common statistical distributions- Discrete and Continuous. Simulation of random vectors, Generating Poisson processes and Markov chain.

UNIT III (15 Hours)

Applications of simulation

Discrete event simulation; Monte Carlo integration; Variance reduction techniques; Applications to statistical inference; Point Estimators, Confidence Intervals and hypothesis tests.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

PRACTICAL/ LAB WORK – (30 hours)

List of Practical:

1. Pseudo random number generators.
2. Generation of U (0, 1).
3. Problems based on statistical tests.
4. Application to standard statistical distributions (discrete and continuous):
   (a) The inverse transforms method.
   (b) Acceptance-Rejection method.
5. Problems based on Composition Method.
6. Problems based on Monte Carlo integration.
7. Problems based on Regenerative methods.

ESSENTIAL READINGS:

- Rubinstein, R.Y. (2017). *Simulation and the Monte Carlo Methods*, Wiley.
- Voss, J. (2014). *An introduction to statistical computing: a simulation-based approach*, Wiley series in computational statistics.
- Sheldon M. Ross (2022) *Simulation, Sixth Edition,* Elsevier Academic press publication.
- Averill M. Law and W. David Kelton (1991). *Simulation modeling and analysis:* McGraw-Hill, Inc., New York.

SUGGESTED READINGS:

- Reitman, J. (1971). *Computer simulation Applications,* John Wiley & Sons.
- Swarup, K. Gupta, P.K. and Mohan, M. (2014). *Operations Research,* 15th Ed, Sultan Chand & Sons.
- Fishman, G.S. (1996). *Monte Carlo-Concepts, Algorithms and Applications*, Springer.