GENERAL ELECTIVE COURSE – 7C: ELEMENTS OF STOCHASTIC PROCESS

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		
Elements of Stochastic Process	4	3	0	1	Class XII pass with Mathematics.	Basic knowledge of Statistics, Probability theory, and discrete Probability distributions

Learning Objectives:
The learning objectives include:

- Introduce the concept of probability generating function
- To understand transitions through Markov chains
- To identify real-life applications of stochastic processes.

Learning Outcomes:
After completing this course, students should have developed a clear understanding of:

- The fundamental concepts of stochastic processes.
- The basic concepts of probability generating functions and it's applications.
- Tools needed to analyze stochastic processes.
- Markov processes and Markov chains.
- Basic applications of Markov chains.
- Poisson processes and its properties.

SYLLABUS OF GE-7c

Theory

UNIT I **(15 hours)**

Generating functions, probability generating functions and their applications in discrete distributions. Stochastic Process: Parametric space and State space with examples. Covariance Stationary processes.

UNIT II **(15 hours)**

Markov Chains: Definition of Markov Chain, States of Markov chain, transition probability matrix, order of Markov chain, higher transition probabilities of Markov chain.
Classification of States as Transient, Persistent, Null, Non-null, and Ergodic.
Reducible and irreducible Markov chains, Stability of Markov system (numerical only).

UNIT III **(15 hours)**

Poisson Process: postulates of Poisson process, properties and applications of Poisson process.

PRACTICAL/LAB WORK – (30 hours)

List of Practicals:

1. Generating probability distributions- Binomial, Poisson and geometric and obtaining their pgfs.
2. Generating sequence of numbers using the given generating function.
3. Computing probability generating function using the given sequence of probabilities and obtaining the mean & variance of the r.v. from the pgf.
4. Extracting probability distributions from the probability generating functions.
5. Examining covariance stationarity of a stochastic process.
6. Constructing the transition probability matrix from the given problem and calculating various probabilities.
7. Computing higher order probabilities from a given t.p.m.
8. Classifying the states of a Markov chain
9. Determining irreducibility of a Markov chain
10. Obtaining stable solution of a Markov chain.
11. Verifying additive property of a Poisson process.
12. Decomposition of a Poisson process.
13. Obtaining the autocorrelation function of a Poisson process.

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

ESSENTIAL READINGS:

- Medhi, J. (2009). Stochastic Processes, New Age International Publishers.
- Gupta and Kapoor (2020). Fundamentals of Statistics, 12th edition, Sultan Chand and sons.

SUGGESTIVE READINGS:

- Basu, A.K. (2005). Introduction to Stochastic Processes, Narosa Publishing.
- Bhat,B.R. (2021). Stochastic Models: Analysis and Applications, New Age International Publishers

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

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