Category II

B.A.(Prog) with Statistics as Non-Major/Major Semester-VII

DISCIPLINE SPECIFIC CORE COURSE–7: STOCHASTIC PROCESSES AND QUEUEING THEORY

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		
Stochastic Processes and Queueing Theory	4	3	0	1		Basic knowledge of Probability theory and Probability distributions

Learning Objectives:
The learning objectives include:

- To understand the concept of stochastic process and markov chain.
- To analyze the queueing models with applications;
- To identify the 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.
- Tools needed to analyze stochastic processes.
- Markov processes and Markov chains.
- Stability of Markov chains.
- Poisson process and its variations.
- Queuing systems.
- Random walk and ruin theory.

SYLLABUS OF DSC-7

Theory

UNIT I
Probability Generating Function **(12 Hours)**
Probability Distributions: Generating functions, Bivariate probability generating functions.
Stochastic Process: Introduction, Stationary Process.

UNIT II

Markov Chain **(18 Hours)**

Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Classification of states and chains, stability of Markov system. Gambler's Ruin Problem: Classical ruin problem, expected duration of the game.

UNIT III

Poisson Process and Queuing theory **(15 Hours)**

Postulates of Poisson process, properties of Poisson process, inter-arrival time, pure birth process, Yule Furry process, birth and death process. Queuing System: General concept, steady state distribution, queuing model, M/M/1 with finite and infinite system capacity, waiting time distribution (without proof).

PRACTICAL/ LAB WORK – (30 hours)

List of Practical:

1. Problems based on probability generating function to compute exact and approximate probabilities using partial fraction theorem.
2. Problems based on (covariance) stationary processes.
3. Markov Chains:
   a) Simulation of Markov chains and Calculation of transition probability matrices.
   b) Stability of Markov chains.
   c) To check whether the given chain is irreducible or not.
4. Simulation and applications of Poisson processes.
5. Calculation of probabilities for given birth and death processes.
6. Calculation of probabilities for ruin problems.
7. Problems based on (M/M/1) queuing models.

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

Essential Reading:

- Medhi, J. (2022). Stochastic Processes, 6th edition, New Age International Publishers.
- Gross, Donald and Harris, Carl M (2017) Fundamentals of Queueing Theory, 5th Edition, Wile International.
- Feller, W. (2008).Introduction to probability Theory and Its Applications, Vol. 3rd Ed., Wiley International.

Suggested Readings:

- Basu, A.K. (2005). Introduction to Stochastic Processes, Narosa Publishing.
- Bhat, B.R.(2021). Stochastic Models: Analysis and Applications, 2nd edition New Age Internation Publishers.
- Taha, H. (2019). Operations Research: An Introduction, 10th edition Prentice-Hall India.

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