6. Fitting of Poisson regression model.
7. Log-linear models for contingency tables.
8. Tests for independence,
9. Tests for marginal and conditional independence,
10. Tests for partial association.

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

ESSENTIAL READINGS

- Dobson, A.J. and Barnett, A.G. (2018): Introduction to Generalized Linear Models, 4th ed., Chapman and Hall/CRC. London.
- Myers, R.H., Montgomery, D.C., Vining, G.G. and Robinson, T.J. (2010): Generalized Linear Models with Applications in Engineering and the Sciences, 2nd ed., John Wiley & Sons.

SUGGESTED READINGS:

- McCullagh, P. and Nelder, J.A. (1989): Generalized Linear Models, 2nd ed., Chapman and Hall.
- Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). Introduction to Linear Regression Analysis (6th ed.). John Wiley and Sons.

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

DISCIPLINE SPECIFIC ELECTIVE COURSE–6D: ADVANCED STOCHASTIC PROCESSES

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		
Advanced Stochastic Processes	4	3	0	1	Class XII Pass with Mathematics.	Advanced Knowledge of Probability Theory and Probability distributions

Learning Objectives:

The learning objectives include:

- To define, design and build stochastic models
- To model and analyze transitions through Markov chains

Learning Outcomes:

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

- Tools needed to analyze stochastic processes.
- Markov chain applications.
- Concept of population growth and extinction of population with Branching Process.
- Recurrence of events based on renewal theory.
- Poisson processes and their applications in Birth and Death models.
- Queuing models and their applications

SYLLABUS OF DSE-6d

Theory

UNIT I **(13 hours)**

Determination Of Higher Transition Probabilities, A periodic Chain: Limiting Behavior, Graph Theoretic Approach, Finite Reducible Chains with a Single non- trivial Closed Class

UNIT II **(15 hours)**

Concept of Characteristic functions, Laplace, and Inverse Laplace Transformations.
Branching Process, properties of generating functions of branching processes, probability of ultimate extinction, and its application.
Renewal Processes in Discrete Time, Relation Between F(s) and P(s) and Renewal Interval.

UNIT III **(12 hours)**

Pure Birth Process, Pure Death Process, Birth And Death Process, Linear Growth Models, Queueing Processes, Steady State Distribution, Little's Formula, Poisson Queuing Models M/M/1: GD/∞/∞ and its characteristics, waiting time distribution under this model, M/M/1: GD/N/∞ and characteristics, Average system length, Average queue length, M/M/C: GD/∞/∞ and its characteristics average queue length, average system length, average waiting time, and problems based on all three models.

PRACTICAL/LABWORK–(30hours)

List of Practical:

1. Simulation of Markov chains.
2. Calculation of higher transition probability matrices.
3. To check whether the given chain is irreducible or not using the concept of stationarity
4. Classification of states.
5. Extinction of population under GW branching Process.
6. Problems based on Renewal theory.
7. Simulation and applications of Poisson processes.
8. Generate the Yule-Furry process and verify that the process follows a geometric distribution.
9. Mean size of population and probability of extinction under linear growth process.
10. Computation of expected customers in the system and expected queue length under (M/M/1);(GD/∞/∞) queuing system.
11. Computation of the Average length of a non-empty queue and the fluctuation (variance) of the number of customers in the system under (M/M/1);(GD/∞/∞) queuing system.
12. Computation of expected number of customers in the system and expected queue length under (M/M/1);(GD/N/∞) queuing system.
13. Computation of expected number of customers in the system and expected queue length under (M/M/C);(GD/N/∞) queuing system .

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

ESSENTIAL READINGS

- Feller, W. (1968). Introduction to probability Theory and Its Applications, Vol, 3rd Ed., Wiley International.
- Medhi, J. (2022) Stochastic Processes, Sixth edition New Age International Publishers.
- Sheldon M. Ross (2007): Introduction to Probability Models, 9th edition, Academic Press publications
- Karlin & Taylor (1975): A first course in stochastic processes, 2nd edition, Academic Press publications

SUGGESTIVEREADINGS:

- Basu, A.K. (2005). Introduction to Stochastic Processes, Narosa Publishing.
- P.G. Hoel, S.C. Port and C.J. Stone (1986): Introduction to Stochastic Processes. Waveland Press
- J.G. Kemeny, J.L. Snell and A.W. Knapp (1960): Finite Markov Chains.
- Geoffrey R, Grimmett & David R. Stirzaker (2004), Reprint: Probability and Random Processes
- Bhat, B.R. (2021). Stochastic Models: Analysis and Applications, New Age International Publishers.

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