

ST2 C09: STOCHASTIC PROCESSES

UNIT I

Introduction to stochastic processes:- classification of stochastic processes according to state space and time space, wide sense and strict sense stationary processes, processes with stationary independent increments, Markov process, Markov chains-transition probability matrices, Chapman-Kolmogorov equation, first passage probabilities, generating functions, classification of states, criteria for recurrent and transient states, mean recurrence time, mean ergodic theorem, the basic limit theorem of Markov chains (statement only), reducible and irreducible Markov chains, stationary distributions, limiting probabilities and absorption probabilities.

UNIT II

Random walk, gambler's ruin problem; Galton-Watson branching process, generating function relations, mean and variance functions, extinction probabilities, criteria for extinction.

UNIT III

Continuous time Markov chains, Poisson processes, pure birth processes and the Yule processes, birth and death processes, Kolmogorov forward and backward differential equations, linear growth process with immigration, steady-state solutions of Markovian queuing models--M/M/1, M/M/1 with limited waiting space, M/M/s, M/M/s with limited waiting space and M/G/1.

UNIT IV

Renewal processes– concepts, examples, Poisson process viewed as a renewal process, renewal equation, elementary renewal theorem, asymptotic expansion of renewal function, central limit theorem for renewals, key renewal theorem (statement only), delayed renewal processes.

Text Books:

1. Ross S.M. (2007) Introduction to Probability Models, Ninth edition, Academic Press.
2. Bhat B.R. (2002) Stochastic Processes, second edition, New Age Publication.

Reference Books:

1. Feller W. (1968) Introduction to Probability Theory and its Applications, Vols. I & II, John Wiley, New York.
2. Karlin S. and Taylor H.M. (1975) A First Course in Stochastic Processes, Second edition, Academic Press, New-York.
3. Cinlar E. (1975) Introduction to Stochastic Processes, Prentice Hall, New Jersey.
4. Medhi J. (1996) Stochastic Processes. Second Editions, Wiley Eastern, New-Delhi.
5. Basu A.K. (2003) Introduction to Stochastic Processes, Narosa, New-Delhi.
6. Bhat U.N. and Miller G. (2003) Elements of Applied Stochastic Processes. (Third edition), John Wiley, New York.