

Hard Core	STH 453: STOCHASTIC PROCESSES	No. of credits: 4
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Course Outcomes:

CO1: To construct transition matrices for Markov dependent behavior and summarize process information.

CO2: To learn random walk and gambler's ruin problem; Statistical inference in MC

CO3: To understand the principles and objectives of model building based on Markov chains, Poisson processes and Brownian motion.

CO4: To learn Renewal theory and Stationary process

CO5: To use notions of long-time behavior including transience, recurrence, and equilibrium in applied situations such as branching processes

Unit I

Introduction to Stochastic Processes; classification according to state space and time domain. Countable state Markov Chains(MC's), Chapman-Kolmogorov equations; calculation of n-step transition probability and its limit. (9 hrs)

Unit II

Stationary distribution, classification of states, transient MC; random walk and gambler's ruin problem; Statistical inference in MC. (10 hrs)

Unit III

Discrete state space continuous time MC: Kolmogorov-Feller differential equations; Poisson process, birth and death process; Applications to queues and storage problems. Brownian motion process and its properties, Wiener process as a limit of random walk; first-passage time and other problems. (13 hrs)

Unit IV

Renewal theory: Elementary renewal theorem and applications. Statement and uses of key renewal theorem; study of residual life time process. Stationary process: weakly stationary and strongly stationary processes. (12 hrs)


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Unit V

Branching process: Galton-Watson branching process, probability of ultimate extinction, distribution of population size, Martingale in discrete time, inequality, convergence. (12 hrs)

References:

- 1) A.K. Basu (2003): Introduction to Stochastic Processes, Narosa Publishers.
- 2) Cinlar E. (1975): Introduction to Stochastic Processes, Prentice Hall.
- 3) Ross S.M. (1996): Stochastic Processes 2nd Ed., John Wiley & Sons.
- 4) Bhat B.R. (2004): Stochastic Models: Analysis and Applications, New Age International.
- 5) Karlin S. and Taylor, H.M. (1998): A First Course in Stochastic Processes 3rd Ed., Vol.I, Academic Press.
- 6) Medhi J. (1994): Stochastic Processes 2nd Ed., Wiley Eastern.

