


STOCHASTIC PROCESSES

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TYPE OF COURSE : Rerun | Core | UG
IPRE-REQUISITES : A basic course on Probability
EXAM DATE : 17 Nov 2019
COURSE DURATION : 12 weeks (29 Jul'19 - 18 Oct'19)

INDUSTRIES APPLICABLE TO : Goldman Sachs, FinMachenics, Deutsche Bank and other finance companies.

COURSE OUTLINE

This course explains the stochastic processes & concepts which students need for their experiments and research. It also covers theoretical concepts pertaining to handling various stochastic modeling. This course provides classification and properties of stochastic processes, discrete and continuous time Markov chains, simple Markovian queueing models, applications of CTMC, martingales, Brownian motion, renewal processes, branching processes, stationary and autoregressive processes.

ABOUT INSTRUCTOR

Prof. S. Dharmaraja Department of Mathematics Indian Institute of Technology,Delhi earned his M.Sc. degree in Applied Mathematics from Anna University, Madras, India, in 1994 and Ph.D. degree in Mathematics from the Indian Institute of Technology Madras, in 1999.

Prof. N. Selvaraju, Department of Mathematics, Indian Institute of Technology Guwahati earned his M.Sc. degree in Applied Mathematics from Anna University, Madras, India, in 1994 and Ph.D. degree in Mathematics from the Indian Institute of Technology Madras, in 1999.

COURSE PLAN

Week 1: Probability theory refresher; Introduction to stochastic process; (contd.)

Week 2: Probability theory refresher (contd.) Problems in random variables and distributions; Problems in Sequence of random variables

Week 3: Definition and simple stochastic process; Definition, classification and Examples; Simple stochastic processes

Week 4: Discrete-time Markov chains; Introduction, Definition and Transition Probability Matrix Chapman-Kolmogorov Equations; Classification of States and Limiting Distributions

Week 5: Discrete-time Markov chains (contd.); Limiting and Stationary Distributions; Limiting Distributions, Ergodicity and stationary distributions. Time Reversible Markov Chain, Application of Irreducible Markov chains in Queueing Models; Reducible Markov Chains

Week 6: Continuous-time Markov chains; Definition, Kolmogrov Differential Equation and Infinitesimal Generator Matrix Limiting and Stationary Distributions, Birth Death Processes; Poisson processes

Week 7: Continuous-time Markov Chains (contd.); M/M/1 Queueing model; Simple Markovian Queueing

Week 8: Applications of CTMC; Queueing networks; Communication systems; Stochastic Petri Nets

Week 9: Martingales; Conditional Expectation and filteration; Definition and simple examples

Week 10: Brownian Motion; Definition and Properties; Processes Derived from Brownian Motion; Stochastic Differential Equation

Week 11: Renewal Processes; Renewal Function and Equation; Generalized Renewal Processes and Renewal Limit Theorems Markov Renewal and Markov Regenerative Processes; Non Markovian Queues; Application of Markov Regenerative Processes

Week 12: Branching Processes, Stationary and Autoregressive Processes