UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 685 Stochastic Processes

Course Description: Stochastic processes are fundamental to the study of mathematical finance, but are also of vital importance in many other areas, from neuroscience to electrical engineering. Topics to be covered: Elements of stochastic processes, Markov chains and processes, Renewal processes, Martingales (discrete and continuous times), Brownian motion, Branching processes, Stationary processes, Diffusion processes, the Feynman-Kac formula, Kolmogorov backward/forward equations, Dynkin's formula.

Prerequisite: One of Mathematics 331, 335, 355 or 367, one of Mathematics 311 or 313, and Statistics 321, or consent of Department.

Antirequisite: Credit for Statistics 761 and Mathematics 685 will not be allowed.

Textbook: "A First Course in Stochastic Processes" by S. Karlin and H. Taylor, Academic Press, 1975 (2nd ed.)

(see Course Descriptions under the year applicable: http://www.ucalgary.ca/pubs/calendar)

Syllabus

Topics	**Number of Hours**
Elements of random variables and stochastic processes: review of basic terminology, classifications, definitions, convergences (different modes, LLN, CLT)	4
Martingales (discrete and continuous times): definitions, examples, supermartingales and submartingales, the optional sampling theorem (OST), applications of OST	6
Markov chains and processes: examples, discrete and continuous times, transition probabilities, classification of states, Poisson/compound Poisson processes, semi-groups of operators, generators	10
Random walks, Brownian motion, functionals of BM by martingale methods, multidimensional BM	5
Stationary processes: definition, examples, ergodic theorem, Gaussian systems, stationary point processes	2
Renewal processes (RP): definition, examples, renewal equation and renewal theorem, application of RP	3
Branching processes (BP): discrete time and continuous times, generating function	3
Extinction probabilities, birth and death processes, continuous-time BP, applications	3
TOTAL HOURS	**36**

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Last modified on 2016-03-24

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