FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 681 Stochastic Calculus for Finance

Calendar Description: Martingales in discrete and continuous time, risk-neutral valuations, discrete- and continuous-time (B,S)-security markets, Cox-Ross-Rubinstein formula, Wiener and Poisson processes, Ito's formula, stochastic differential equations, Girsanov's theorem, Black-Scholes and Merton formulas, stopping times and American options, stochastic interest rates and their derivatives, energy and commodity models and derivatives, value-at-risk and risk management.

Prerequisites: Applied Mathematics 481

Antirequisite: Applied Mathematics 581

Textbook: Continuous-time Models' by Steven Shreve, Springer, 2004

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

Syllabus

Topics:	**Number of Hours**
Introduction: basics of probability, stochastic processes and math finance	1
Conditional expectation, martingales in discrete and continuous times, Examples	2
Discrete-time (B,S)-security markets: capital, portfolio, arbitrage, completeness, self-financing, risk-neutral valuation and measure, options, Cox-Ross-Rubinstein option pricing formula	3
Brownian motion: definition and properties, quadratic variation, Markov property, reflection principle and application to first passage time distribution	6
Stochastic calculus: Ito integral, Ito processes, Ito formula, integration by parts formula, multivariable stochastic calculus, stochastic differential equations, examples	8
Continuous-time (B,S)-security markets: equivalent probability measures and the Girsanov Theorem; financial capital, self-financing portfolios, arbitrage, market completeness; risk-neutral valuation and measure, first and second fundamental theorems of asset pricing, applications to option pricing, Black-Scholes-Merton formulas	8
Stopping times, American options	1
Stochastic interest rates and their derivatives	2
Stochastic models in energy and commodity markets, derivatives	3
Value-At-Risk and risk management	2
TOTAL:	**36**

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Last modified on 2016-03-24

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