26:711:563 Stochastic Calculus for Finance

Course Description

The objective of the course is to provide the students with knowledge and skill sufficient for correct formulation and analysis of continuous-time stochastic models involving stochastic integrals and stochastic differential equations. Particular attention will be devoted to application of stochastic calculus methods in finance, such as models of evolution of stock prices and interest rates, pricing of options, and pricing of other contingent claims.The course will also prepare the students for independent research on problems involving stochastic calculus techniques.

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Syllabus

Week	Topic
1	Random sequences. Discrete-time martingales.
2	Random walk. Reflection principle.
3	Discrete-time stock models. Valuation of claims.
4	Brownian motion.
5	Continuous time martingales.
6	Stochastic integral.
7	Ito formula. Stochastic differential equations.
8	Integration by parts. Stochastic Fubini theorem.
9	Girsanov theorem. Feynman-Kac equation.
10	The Black-Scholes model.
11	Martingale methods for valuation of complex contingent claims.
12	Stopping problems. Application to American options.
13	Numerical methods for option valuation.
14	Multifactor models.
15	Stochastic volatility models.

Prerequisites

26:960:575 Probability and Statistics
26:960:580 Stochastic Processes

Reading List

Main textbook:

1. A. Etheridge, *A Course in Financial Calculus*, Cambridge University Press 2002

Supplementary books:

2. I. Karatzas and S. E. Shreve, *Brownian Motion and Stochastic Calculus*, Springer 1997.
3. M. Musiela and M. Rutkowski, *Martingale Methods in Financial Modelling*, Springer 1997.

Evaluation Criteria

The course grade will be based on the following components:

1. Homework assignments (30%)
2. Computational projects (20%)
3. Midterm exam (20%)
4. Final exam (30%)