

FE610 Stochastic Calculus for Financial Engineers

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Course Catalog Description


Introduction

This course provides the mathematical foundation for understanding modern nancial theory. It includes topics such as basic probability, random variables, discrete continous distributions, random processes, Brownian motion, and an introduction to Ito’s calculus. Applications to nancial instruments are discussed throughout the course.

Campus	Fall	Spring	Summer
On Campus	X		
Web Campus		X	

Instructors

Professor	Email	Office
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More Information

Course Description

This course is designed for first year graduate students in Financial Engineering. The goal is to learn the foundation on which Financial engineering is built upon. It is highly recommended that students have a strong background in applied mathematics (analysis) and probability. This is a core course for all programs in Financial Engineering.

Prerequisites: Background in probability and applied mathematics

Course Outcomes

At the end of this course, students will be able to:

1. classify stochastic processes as martingales, Markov, or both/neither
2. simplify stochastic (Ito) integrals
3. determine the differentials of functions of stochastic processes
4. change probability measures to facilitate pricing of derivatives
5. solve stochastic differential equations through transformations to partial differential equations.

Course Resources

Textbook

Stochastic Calculus for Finance vol II, by Steven E. Shreve, Springer Finance, 2004, ISBN-13: 978-0387401010 (vol II).

Additional References

Stochastic Calculus for Finance vol I, by Steven E. Shreve, Springer Finance, 2004, ISBN-13: 978-0387249681 (vol I).

Introduction to Probability Models, 10th edition, by Sheldon M. Ross, Academic Press, 2009, ISBN-10: 0123756863, ISBN-13: 978-0123756862.

Probability and Random Processes, by Geoffrey Grimmett and David Stirzaker, Oxford University Press 2001.

Stochastic Integration and Differential Equations, by Philip E. Protter, Springer 2005. ISBN-13: 9783642055607

Stochastic Differential Equation, by Bernt Oksendal, 6th edition, 2010, ISBN-10: 3540047581, ISBN-13: 978-3540047582

Introduction to the Mathematics of Financial Derivatives, by Salih N Neftci, 2nd ed, Associated Press, 2000, ISBN 0125153929.

Grading

Grading Policies

The final grade in the class will be determined in the following manner:

- 20% Homeworks
- 30% Midterm
- 50% Final Exam

Please note that your grade will be determined solely on the work you present over the course of the semester. No consideration such as your need for a better grade will be considered.

Extra Credit

Possibly on the exams, there will be the occasional extra credit problem. This is the only source of extra credit for the course. There are no "extra assignments" that students can do to raise their average outside of the ones assigned. There are no exceptions, don't even bother coming to me and asking about extra work and the end of the semester, as I will only direct your attention to this part of the syllabus.

Lecture Outline

	Topic	Reading
Week 1	Probability review: Random variables and vectors. Stochastic processes.	Ch. 1 and 2
Week 2	Random walk. Brownian motion.	Ch. 3
Week 3	Markov Property, Reflection Principle and Passage Times	Ch. 3
Week 4	Stochastic Calculus(Integrands)	Ch. 4
Week 5	Ito lemma and applications	Ch. 4

Week 6	Black-Scholes-Merton Model	Ch. 4
Week 7	Multivariable Stochastic Calculus	Ch. 4
Week 8	Midterm	
Week 9	Risk-Neutral Measure and Girsanov	Ch. 5
Week 10	Multidimensional Stock Model	Ch. 5
Week 11	PDE's and SDE's	Ch. 6
Week 12	Poisson Processes and Jump Diffusion	Ch. 11
Week 13	Exotic Options	Ch. 7
Week 14	Review & Catch-up	

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