

FE 543 Intro to Stochastic Calculus for Finance

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Office hours: TBD and by appt.

Objectives

This course is designed for advanced undergraduate students and masters students in Financial Engineering. The goal is to learn the foundation on which Finance is built upon. The students are supposed to have a strong background in applied mathematics (analysis) and probability at an undergraduate level.

Textbook(s):

The main textbooks used are:

- *Stochastic Calculus for Finance* vol I and II, by Steven E. Shreve, Springer Finance, 2004, ISBN-13: 978-0387249681 (vol I) and 978-0387401010 (vol II).

I will also as necessary provide additional notes to the textbook material. In addition the following textbooks provide additional references:

- *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.
- *Introduction to Stochastic Calculus With Applications* by Fima C. Klebaner, , ISBN-10: 1848168322, ISBN-13: 978-1848168329
- *Financial Calculus: An Introduction to Derivative Pricing* by Martin Baxter, Andrew Rennie, 1996, ISBN-10: 0521552893, ISBN-13: 978-0521552899
- *Stochastic Differential Equation*, by Bernt Øksendal, 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.

Course outline:

Week	Material	Reference
Week 1	Binomial tree. Discrete asset price model.	Ch. 1 in vol. I
Week 2	Probability review. Discrete probability.	Ch. 2 in vol. I
Week 3	Applications to coin toss space.	
Week 4	Random walks.	Ch. 5 in vol. I
Week 5	Brownian Motion	Ch. 3 in vol. II
Week 6	Martingales. Markov Chains.	Ch. 2 in Vol. I Ch. 3 in Vol. II
Week 7	Poisson Process and Compound Poisson Process	Ch. 11 in vol II Notes
Week 8	Midterm	
Week 9	Stochastic Integral & Itô's lemma	Ch. 4 in vol. II
Week 10	Applications of Itô's lemma	
Week 11	Black Scholes model	Ch. 4 in vol. II
Week 12	Stochastic Differential equations	Ch. 4 in vol. II
Week 13	Change of Measure. Radon-Nikodym.	Ch. 3 in Vol I
Week 14	Review & Catch-up	

Homework, Exams and Grading:

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

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

Homeworks

Homework will be assigned roughly every two weeks. Collaboration is encouraged as it is necessary to understand some of these concepts. Be certain that the work you hand in is yours, however. For guidelines of what is considered good collaboration see the page marked "Collaboration vs. Academic Misconduct." No late homeworks will be accepted, however the lowest homework grade will be dropped.

Exams

There will be one midterm and one final exam given in the class. If you miss an exam, you must provide a written explanation signed by proper authorities in order to be allowed the chance to take a replacement exam.