

MATH 6910: STOCHASTIC CALCULUS IN FINANCE - WINTER 2010

This course will introduce the basic ideas and methods of stochastic calculus and apply these methods to financial models, particularly the pricing and hedging of derivative securities. We start by introducing the concepts of arbitrage and risk-neutral pricing in a discrete-time setting, then move to more sophisticated continuous-time models. Along the way we cover the following mathematical topics: Brownian motion, stochastic integration, Itô's formula, martingales and the Cameron-Martin-Grisanov transformation.

Prerequisites: A solid knowledge of calculus and undergraduate probability theory will be assumed. Necessary concepts from measure theory and stochastic processes will be introduced as they are needed. A quick review sheet is posted on the course website.

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(Please include [6910] in the subject heading, text only - no html, no "texting".)

Office: Ross N621B

Office Hours: MW 2-3pm, or by appointment. No drop-ins, please. Other aid hours may be announced as the course progresses.

Lectures: Fridays 2:30-5:30pm, in ACW104. Please note that this course honours both the York and Schulich reading weeks, and there will be no lectures during these times.

Grading Scheme: Assignments (weekly): 30%, Term test 30%, Final exam: 40%. Dates, times, locations TBA.

Course web-page: <http://www.math.yorku.ca/~hkj/Teaching/6910/>

Important course information will be posted on the website. I expect that you will check the site on a regular basis.

Textbook (required): Steve Shreve, *Stochastic Calculus for Finance II (Continuous-Time Models)*. Springer Verlag, 2006.

Time-permitting, I hope to cover Chapters 1-6.

COURSE POLICIES:

- All homework must be handed in at the **beginning** of the lecture on the day on which it is due. Late homework will not be accepted. Additional exercises will also be assigned on a regular basis (see website), and you are responsible for completing these.
- There will be **no make-up tests** scheduled. In case of illness supported by medical documentation, the final grade will be based on 70% of the final exam, and 30% of the assignments.
- You must write and pass the final exam in order to get a passing grade in the course.
- You are encouraged to discuss the homework problems with others, since this is often a good way to learn. However, you must write up your own solutions, and what you turn in should reflect your own understanding of the material. If two or more student papers appear to be copies, **all** will receive a zero grade.
- Class attendance is required. If you do miss a class, it is your responsibility to find out what was covered (from a fellow student) and whether any important announcements were made. Class participation is strongly encouraged – if you don't get something, ask!

OTHER REFERENCES (quoting Tom Salisbury):

- Financial Calculus by Baxter and Rennie; Cambridge 1996. A nice survey of the ideas behind risk neutral valuation. Not much detail about stochastic calculus though.
- A Course in Financial Calculus by Alison Etheridge, Cambridge, 2002. Baxter and Rennie, but more mathematically.
- Stochastic Calculus and Financial Applications by J.M. Steele, Springer Verlag 2001 A good introduction, at a similar level to Shreve's book. If we weren't using Shreve's book as a text, we'd be using this one.
- Textbook-level treatments of stochastic calculus:
 - Introduction to Stochastic Integration by Chung and Williams, 2nd edition, Birkhauser 1990. A nice introduction to the theoretical side of stochastic calculus.
 - Stochastic Calculus by Rick Durrett, CRC Press. A more extensive treatment, though still at a textbook-level.
 - Stochastic Differential Equations by Oksendal, Springer Verlag Emphasis on applications, mostly not financial though.
- Advanced reference books for stochastic calculus, doing much more than we'll have time for:
 - Brownian Motion and Stochastic Calculus by Karatzas and Shreve, Springer.
 - Continuous Martingales and Brownian Motion by Revuz and Yor, Springer.
 - Diffusions, Markov Processes, and Martingales, Vol 1,2 by Rogers and Williams, Wiley.
- A more extensive treatment of mathematical finance:
 - Methods of mathematical finance by Karatzas and Shreve, Springer 1998.
- Financial engineering (with less emphasis on the mathematical aspects):
 - Options, Futures, and other Derivatives by Hull, Prentice Hall.
 - Derivatives by Paul Wilmott, Wiley 1998