Mathematics in Finance

Department of Information, Risk and Operations Management
McCombs School of Business
RM 391 - Spring 2012

Course information

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Class times: Monday, 2-5:00pm, CBA 4.338
Office hours: Tuesday 10-12, Thursday 10-11 and by appointment.

Description: This is a doctoral-level course, intended to prepare students for research in Quantitative Finance. The course will provide an introduction to continuous time Finance. The topics covered include portfolio management, derivative pricing, risk measures and equilibrium asset pricing, both in complete and incomplete markets. If time permits, we will also cover term structure models and credit risk. In the first two weeks of the course we will cover elements from stochastic calculus that will be used throughout the class.

Prerequisites: There are no formal course prerequisites, but this course is the continuation of FIN 395.3, "Asset Pricing Theory".

While FIN 395.3 dealt with discrete time models, RM 391 deals with models in continuous time. Some basic knowledge of real analysis, partial differential equations and stochastic processes will be very helpful.

Grading: Grades will be based on homework assignments, one midterm take-home exam and one take-home final exam. (40% homework assignements, 20% midterm and 40% final exam).

All work is individual. You will receive 6-8 homework assignments throughout the semester.

Assigned homework should be turned in through Blackboard by the beginning of class on the listed due date. No late homework will be accepted.

Textbook: There will not be a textbook for the course, but we will rely on the following books. I will also distribute notes for each topic.

· Stochastic Calculus for Finance II, by S. Shreve
· Continuous Time Finance, by R. Merton
. Martingale methods in financial modelling, by M. Musiela and M. Rutkowski
· Theory of Asset Pricing, by G. Pennacchi

List of Topics

Mathematics Tools

Monday, January 23
Random variables, probability spaces, distributions
Filtrations and conditional expectation.
Martingales, Brownian motion
Ito's calculus
Monday, January 30:
Stochastic differential equations
Feynmac-Kac formula
Hitting times and reflection principle

Portfolio choice

Monday, February 6:
Expected utility models
Portfolio choice
Hamilton-Jacobi-Bellman equation
Monday, February 13:
Duality methods
Monday, February 20:
Optimal portfolio choice in incomplete markets
Monday, February 27:
Transaction costs
Robustness
Portfolio choice under alternative criteria
(long-term growth, entropic, risk-sensitive etc.)

Behavioral finance

Monday, March 5:
Behavioral finance
Ambiguity, loss aversion

Derivative valuation

Monday, March 19:
Derivative pricing
Fundamentals of derivative valuation in complete markets
Monday, March 26:
Valuation of european-type derivatives

Black and Scholes equation
Sensitivities
Monday, April 2:
Valuation of early exercise claims
Optimal stopping
Monday, April 9:
Valuation of path-dependent claims
Exotic derivatives

Indifference valuation and risk measures

Monday, April 16:
Indifference valuation
Monday, April 23:
Risk measures

Asset price equilibrium

Monday, April 30:
Asset price equilibrium