# 21-420 : Continuous-Time Finance

Spring 2012

**Instructor:** Scott Robertson

Office : Wean Hall 8214
Phone : 412-268-3811
Email : scottrob@andrew.cmu.edu

**Course Website:** On Blackboard *www.cmu.edu/blackboard*

**Lectures:** Monday, Wednesday, Friday : 2:30 PM - 3:20 PM in Baker Hall A53.

**Prerequisites :** 21-260 (ODE's), 21-370 (Discrete-Time Finance) and a calculus-based Probability class (21-325, 36-225, or 36-217).

**Textbook:**

*Stochastic Calculus for Finance II : Continuous-Time Models*
Steven E. Shreve
Springer
ISBN-13: 978-1-12-4419-2311-0

**Office Hours:** Monday 9:00 AM - 10:00 AM, Thursday 12:00 PM - 1:00 PM and/or by appointment.

**Grading:** The course grade is determined as follows:

Midterm 1: 25%     Midterm 2: 25%     Final : 25%     Homework : 25%

**Teaching Assistants:** There are two Teaching Assistants for the the course:

Brian McFarland        email : bmcfarla@andrew.cmu.edu
Stephen Ma             email : sxma@andrew.cmu.edu

**Recitation Sessions:** Thursdays at 7:00 PM in Wean Hall 5403.

**Homework:** There will be 6-8 homework assignments (roughly one assignment every two weeks). Homework is due at the beginning of class on the assigned due date. Homework assignments must be completed individually. Late homework will not be accepted.

**Course Objectives :** In this class students will learn fundamental results from the theory of Mathematical Finance in the context of continuous time models. In particular, we will cover:

- The Black-Scholes-Merton equation.
- The risk neutral pricing formula for derivatives in complete markets.
- Fundamental theorems of asset pricing.

To derive and support understanding of the above results, we will also cover a number of topics from the fields of Probability, Stochastic Processes and Partial Differential equations. Specifically, students will learn about

- Brownian motion and geometric Brownian motion.
- Quadratic variation and stochastic integration.
- Itô's formula and Itô diffusions.
- The connections between Itô diffusions and partial differential equations.

- Change of probability and Radon-Nikodym derivatives.
- Conditional expectation and Martingales.

**Course Outline (Tentative)**

- Brownian Motion and its properties.
- Stochastic Calculus : Stochastic integrals and Itô's formula.
- Black-Scholes-Merton equation.
- Change of measure and risk neutral pricing.
- Connections with partial differential equations.