Math 590: Stochastic Calculus I

4:00-5:15pm, TuTh, Fall, 2005

Yong Zeng

Course Description: This course will study stochastic calculus for stochastic procesess of right-continuous paths with left limit, which extends Ito's integral for continuous-path martingale to semimartingale. It intends to present the basic ideas, concepts and methods of stochastic calculus to students with a good background in probability based upon measure theory and in real analysis. It is designed to build a solid foundation for students with intention to Ph.D degrees in probability and statistics, with applications to mathematical finance and econometrics. The presentation will be focused on theoretical analysis with heuristic examples and applications.

Brief Outline: Topics to be covered include continuous-time Martingale, Poisson process and Brownian motion, Levy process, local martingale, semimartingale, stochastic integrals based on semimartingales, quadratic variation of semimartingales, Itô's formula for semimartingale, Doob-Meyer Decomposition of semimartingale, quasimartingales, compensators, Fundamental Theorem of local Martingales, Girsannov Theorem for semimartingales, Bichteler-Delacherie Theorem, Natural and Predictable processes, martingale representation theorem for predictable integrands, and stochastic differential equations based on semimartingales.

Basically, most of Chapters 1-4 of Protter's book

Prerequisites: "Probability and Measure" by P. Billingsley, Third Edtion, Wiley, 1995 or equivalent.

Text: The *required* textbook is "Stochastic Integration and Differential Equations" by Philip Protter, Second edition, Springer, 2003.

Other References:

1. "Stochastic Differential Equations" by Bernt Oksendal, fifth edition, published by Springer, 2000.
2. "Brownian Motion and Stochastic Calculus" by Karatzas and Shreve, 2nd ed., Springer, 1991.
3 and 4. "Statistics of Random Processes I: General Theory" and "Statistics of Random Processes II: Applications" by Robert S. Lipster and Albert N. Shiryaev, second edition, published by Springer, 2001.
5. "Markov Processes: Characterization and Convergence", by Ethier and Kurtz, Wiley, 1986.
6. "Limit Theorems for Stochastic Processes" by Jacod and Shiryaev, second edition, Springer-Verlag, 2003.

Grading: There will be assignments worth a total of 70% of your grade, and a take-home final worth 30%. There will be roughly 9-12 assignments for the course. You are permitted to discuss homework problems, but you must write up the solutions independently. Homework can be corrected to earn back lost credits. **Late Assignment will be penalized by 10%.**

How to Reach Me:
E-mail: zeng@mendota.umkc.edu
Phone: (816) 235 5850 **Office:** Rm307A, Manheim
Office Hours: 12:00–1:00pm, Tu, at my office, or by appointments gladly