STOR 836 – Stochastic Analysis
Fall 2014
Monday-Wednesday 11:00-12.15

- This course will cover the basic elements of continuous time stochastic processes and stochastic calculus. The mathematical tools developed here are useful in many different areas such as engineering, mathematical finance, systems biology, stochastic networks, geophysics, fluid dynamics etc. The course should be accessible to anyone with background in measure theoretic probability. For example, STOR 634-635 is more than adequate preparation for this course. There will be no exams. Grades will be based on homework and active class participation.

Syllabus:

- Stochastic Processes: Basic definitions and results in continuous time. Introduction to filtrations, Stopping times, Martingales, Markov processes.
- Important Examples: Poisson process, Brownian motion, Levy process, Jump-Diffusions.
- Stochastic integration with respect to a continuous semi-martingales. Construction, properties and basic theory.
- Ito's formula, Girsanov's theorem and Martingale representation theorem.
- Stochastic differential equations: Existence and uniqueness of solutions, Markov property of the solution.
- Weak convergence results: Convergence of Markov chains to diffusions, Martingale central limit theorem, Renewal functional central limit theorem.
- Feynman-Kac formula and connection with elliptic PDEs.
- Martingale problem of Stroock and Varadhan.
- Some applications.

References: Lectures will be based on instructor's notes and there is no required textbook for this class. However, the following books may be useful.

- *Stochastic Analysis*: Karatzas and Shreve, Revusz and Yor, Protter, Ethier and Kurtz, Oksendal.
- *Probability Background*: Durrett (Probability: Theory and Examples), Williams (Probability with Martingales), Chung (A Course in Probability Theory).
- *Topology, Analysis and Functional Analysis Background*: Royden(Real Analysis), Munkres(Topology), Kolmogorov and Fomin (Functional Analysis).