Stochastic Differential Equations
FALL 2019, MA748

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This course is an introduction to the theory of stochastic differential equations driven by Brownian motions. It is intended to students in Mathematics and Statistics for an introduction to stochastic analysis and stochastic modeling and to students in Engineering or Economics who wish to learn the rules of modern stochastic calculus such as Ito's formula or Girsanov's theorem. Various types of applications will motivate the new concepts introduced in this course.

Textbook: Bernt Oksendal, "Stochastic Differential Equations: An Introduction with Applications, 6th ed".

Homework: 5–6 Accumulated Homework Assignments.

2 (Take Home) Exams

Final Exam: Take Home Final or Project/Presentation

Grade: 2×100 points (Term Exams), 100 points (Final Exam) and 100 points (Homework).

Lectures:

- Review on Probability theory and Random Variables.
- Construction and properties of Brownian motion.
- Ito's integrals, processes and formula. Martingale representation theorem.
- Stochastic differential equations. Ito's stochastic calculus. Girsanov theorem.
- Diffusions: Markov properties and generators. Approximations. Relations with partial differential equations: Kolmogorov equations, Feynman-Kac formula and boundary value problems.
- Applications to: Filtering problems, Stochastic optimal control. Optimal stopping. Waves in random media. Averaging and homogenization. Black-Scholes pricing theory.

Office Hours: MWF 12:00-1:00 p.m., otherwise Appointment.