FSF3713 Stochastic Analysis 7.5 credits

Stokastisk analys

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FSF3713 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Basic probability theory (e.g., SF3940) and basic knowledge in analysis and linear algebra, especially measure theory and Lebesgue integration.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

- Understand and explain the following concepts: filtration, stochastic process in continuous time, local martingale, martingale, stopping time, quadratic variation.
- Sketch at least one construction of Brownian motion.
- Construct the Ito integral in some generality, and discuss its basic properties.
- Explain Ito's formula and use it for practical computations of, e.g., Ito integrals.
- Discuss basic properties of stochastic differential equations (SDEs), in particular diffusions in one dimension.
- Explain Girsanov's theorem.
- Discuss connections between the theory of SDEs and partial differential equations.
- Solve problems and discuss current research connected to the theory presented in the course

Course contents

- Stochastic processes, martingales, local martingales, stopping times, filtrations, Markov properties.
- Brownian motion.
- The Ito isometry, Ito integrals, Ito's formula.
- Existence and uniqueness of solutions to stochastic differential equations.
- Diffusion processes.
- Girsanov's theorem.
- Probabilistic representations of solutions to partial differential equations.
- The FeynmanKac formula, Kolmogorov's forward and backward equations, recurrence, invariant densities.
- More advanced topics, e.g., local times, if time permits.

Course literature

For example

KaratzasShreve "Brownian motion and stochastic calculus" (ISBN 978-1-4612-0949-2),

RevuzYor "Continuous martingales and Brownian motion" (ISBN 978-3-662-06400-9);

Öksendal "Stochastic Differential Equations" (ISBN 978-3-64214394-6)

Examination

- INL1 - Assignment, 3.5 credits, grading scale: P, F
- TENM - Oral exam, 4.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Homework assignments and oral/written exam.

Other requirements for final grade

Homework assignments completed and oral/written exam passed.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.