

Advanced Mathematics and Statistics – Part Mathematics (8,340) Syllabus

Instructor:

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Time schedule

Course:

Wednesday 21.04./28.04./05.05./12.05./19.05./26.05.10, 1615-1800, Room 10-U142.

Reception:

Please write an email with subject “8,340 Advanced Mathematics and Statistics” to fix an appointment.

Please use the discussion forum at <http://enricodegiorgi.ning.com> for questions which might also be of interest to your colleagues. Register yourself and click on “Forum” and post your question under “Advanced Mathematics and Statistics – Part Mathematics – University of St. Gallen.”

Course description

This part of the course introduces stochastic calculus and some of its applications in Finance. We first define basic concepts in probability theory, as filtered probability spaces, conditional expectations and martingales. We then define the stochastic integral for simple processes first and for general processes then. We present three crucial results in stochastic calculus - the Ito Lemma, the Girsanov Theorem and the Martingale Representation Theorem, - and discuss their relevance for Finance. Finally, we briefly discuss stochastic control problems and an application to portfolio selection.

Content

1. Probability Spaces and Stochastic Processes

- 1.1. Introduction
- 1.2. Filtered Probability Space: Probability Measure, sigma-Algebra, Filtration
- 1.3. Conditional Expectation
- 1.4. Martingales
- 1.5. Radon-Nikodým Theorem
- 1.6. Brownian Motion

2. Stochastic Integral

- 2.1. Motivation
- 2.2. Simple Integrands
- 2.3. General Integrands

3. Itô Calculus

- 3.1. Itô Processes
- 3.2. Itô Lemma
- 3.3. Stochastic Differential Equations

4. Girsanov Theorem and Martingale Representation Theorem

- 4.1. Girsanov Theorem
- 4.2. Martingale Representation Theorem
- 4.3. Applications in Finance

5. Stochastic Control

- 5.1. Hamilton - Jacobi- Bellman Equation
- 5.2. Applications in Finance

Exam

Oral Exam, 20 minutes, included Part Statistics.

Main References

- 1. De Giorgi, Enrico (2010): Advanced Mathematics and Statistics – Part Mathematics, Lecture Notes, HSG.
- 2. Shreve, Steven E. (2004): Stochastic Calculus for Finance, Vol. II, Springer.

Further information and lecture notes available at www.studynet.unisg.ch