Linnæus University

Jnr: 2014/2415 -3.1.2

Course syllabus

Faculty of Technology
Department of Mathematics

4MA203 Stokastisk analys, 7,5 högskolepoäng
Stochastic Analysis, 7.5 credits

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
Second Level

Progression
A1F

Date of Ratification
Approved 2009-12-01
Revised 2014-09-03 by Faculty of Technology. Prerequisites, objectives, content, examinations and type of instructions are revised.
The course syllabus is valid from autumn semester 2015

Prerequisites
4MA201 Foundations of probability 7.5 credits or equivalent.

Objectives

After a completed course the student should be able to:

- know the fundamental structures and methods for describing the concepts of the theory of Ito stochastic differential equations (SDEs) and its application to asset pricing
- apply the aforementioned tools in a given situation
- justify the choices made in a coherent and concise manner
- pursue computations for the Brownian Motion and solutions of SDEs and interpret the results
- perform proofs for properties of BM and solutions to particular SDEs and relate the results to more complex processes
- compare the different notions of existence and uniqueness for solutions of SDEs
- relate a given SDE to a Kolmogorov equation and interpret the solution of the parabolic equation
- set up the SDE for the price of an asset, e.g. shares and options
- communicate on and lead an argument in topics of stochastic differential equations and stochastic asset pricing
- assess the possibilities and limitations of the Black Scholes formula for option pricing
- critically assess the impact of put options on the monetary system and relate to

the counter measures given by the Basel treaties.

Content
The course contains:

- alternative definitions of the Brownian motion
- properties of the Brownian motion, e.g. scaling, martingale, and Markov property as well as properties of its sample paths
- Ito-integrals and its properties
- SDEs: existence and uniqueness of solutions
- explicit solutions of linear SDEs
- properties of Ito processes, i.e. solutions of SDEs
- change of probability measure by the Cameron-Girsanov transformation
- random time change
- the Dynkin Formula
- Kolmogorov's forward and backward equations and Feynman-Kac' formula: the link between SDE's and parabolic equations
- option pricing and hedging in the Black Scholes model.

Type of Instruction
Lectures and seminars. Compulsory assignments may be given during the course.

Examination
The course is assessed with the grades Fail (U), Pass (G) or Pass with Distinction (VG).
Assessment of how well the student fulfills the objectives is achieved by

- graded exercises
- written examination
- oral examination

On request, students may have their credits translated to ECTS-marks. Such a request must be sent to the examiner before the grading process starts.

Course Evaluation
A course evaluation will be carried out at the end of the course in accordance with the guidelines of the University. The result of the course evaluation will be filed at the department.

Required Reading and Additional Study Material
Required reading
Shreve S E *Stochastic calculus for finance II, Continuous-time models*, Springer Verlag 2004.
60 (550) pages.

Oksendal B *Stochastic differential equations*, Springer Verlag 2000.
160 (320) pages.