

Module Description

MA4405: Stochastic Analysis

TUM Department of Mathematics

Module level: Master	Language: English	Module duration: one semester	Occurrence: winter semester
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Credits*: 6	Total number of hours: 180	Self-study hours: 120	Contact hours: 60
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* The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

Description of achievement and assessment methods:

The module examination is based on a written exam (60-90 minutes). Students have to know theoretical foundations of Brownian motion, Lévy's Theorem and Donsker's invariance principle. They are able to understand the basics of stochastic integration and stochastic differential equations and can apply Itô's formula.

Exam type: written	Exam duration (min.): 60-90	Possibility of re-taking: In the next semester: No At the end of the semester: Yes	Homework: No
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Lecture: No	Conversation: No	Written paper: No
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(Recommended) requirements:

MA2409 - Probability Theory

Contents:

Brownian motion: construction and path properties, reflection principle. Stochastic integrals with respect to Brownian motion and Itô's formula. Stochastic integrals with respect to continuous martingales, cross-variation and Itô's product rule. Stochastic differential equations, weak and strong solutions. Lévy's Theorem, Girsanov's Theorem and applications. Donsker's invariance principle.

Study goals:

After successful completion of the module, students are able to:

- define Brownian motion and apply basic calculations involving Brownian motion
- understand fundamental results such as the reflection principle for Brownian motion, Lévy's Theorem and Donsker's invariance principle
- understand the basics of stochastic integration
- apply Itô's formula
- understand the basics of stochastic differential equations
- apply change-of-measure techniques.

Teaching and learning methods:

lecture, exercise module

The module is offered as lectures with accompanying practice sessions. In the lectures, the contents will be

presented in a talk with demonstrative examples, as well as through discussion with the students. The lectures should motivate the students to carry out their own analysis of the themes presented and to independently study the relevant literature. Corresponding to each lecture, practice sessions will be offered, in which exercise sheets and solutions will be available. In this way, students can deepen their understanding of the methods and concepts taught in the lectures and independently check their progress.

Media formats:

blackboard, assignments

Literature:

F. den Hollander, M. Löwe, H. Maassen (1997): Stochastic Analysis, Lecture Notes, University of Nijmegen, Netherlands.

P. Mörters, Y. Peres (2010): Brownian Motion, Cambridge University Press, New York / Melbourne / Madrid / Cape Town / Singapore / Sao Paulo / Delhi / Dubai / Tokyo

Responsible for the module:

Berger Steiger, Noam; Prof. Dr.: noam.berger@tum.de

Courses (Type, SH) Lecturer:

000000213 Stochastic Analysis (3SWS L, WS 2016/17)

Gantert N, Criens D

000000755 Stochastic Analysis (Exercise Session) (1SWS P, WS 2016/17)

Gantert N, Chong C, Criens D

For further information about this module and its allocation to the curriculum see:

<https://campus.tum.de/tumonline/wbModHb.wbShowMHBReadOnly?pKnotenNr=1036308>

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