

MATH-525

Advanced stochastic analysis

Hairer Martin

| Cursus | Sem. | Type |
|---------------|----------|------|
| Ing.-math | MA2, MA4 | Opt. |
| Mathématicien | MA2 | Opt. |

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|----------------------------|-----------------|
| Language of teaching | English |
| Credits | 5 |
| Session | Summer |
| Semester | Spring |
| Exam | Oral |
| Workload | 150h |
| Weeks | 14 |
| Hours | 5 weekly |
| Courses | 3 weekly |
| Exercises | 2 weekly |
| Number of positions | |

Summary

This course will give you in-depth knowledge in some topics of modern stochastic analysis. We will start with a general introduction to Gaussian measure theory followed by an introduction to Malliavin calculus and a selection of advanced topics.

Content

- General measure theory with emphasis on weak convergence.
- Gaussian measure theory on infinite-dimensional spaces.
- Malliavin calculus
- Hörmander's theorem
- Hypercontractivity and fourth moment theorem
- Construction of the Φ^4_2 measure

Keywords

Stochastic analysis, Gaussian measures, diffusions, Wick products, Malliavin calculus

Learning Prerequisites**Required courses**

Analysis I-IV
Probability

Recommended courses

Measures and integration
Probability Theory
Functional Analysis I-II

Important concepts to start the course

Basic concepts in probability theory
Basic functional analysis

Teaching methods

Weekly lectures (on blackboard) and exercise sessions with assistant

Expected student activities

Attending the lectures and solving the exercises

Assessment methods

Oral exam

Supervision

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|--------------|-----|
| Office hours | No |
| Assistants | Yes |
| Forum | No |

Resources**Virtual desktop infrastructure (VDI)**

No

Bibliography

D. NUALART. The Malliavin Calculus and Related Topics, Springer, 2006.

V. I. BOGACHEV. Gaussian measures, vol. 62 of Mathematical Surveys and Monographs. American Mathematical Society, Providence, RI, 1998.

P. BILLINGSLEY. Convergence of probability measures. John Wiley & Sons Inc., New York, 1968.

Ressources en bibliothèque

- [Find the references at the Library](#)

Notes/Handbook

The lecture will mainly follow the notes available at <https://www.hairer.org/notes/Malliavin.pdf>. They will be updated on a regular basis.

Moodle Link

- <https://go.epfl.ch/MATH-525>