MATH-354 **Probability III: Continuous time processes**

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Cursus	Sem.	Type
Mathematics	BA6	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

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Summary

This course extends the concepts exposed in Probability II into the world of continuous time. We explore martingales and Markov processes, guided by the core examples of Brownian Motion and Poisson Processes. A particular emphasis is placed on Brownian Motion, with its innumerable applications.

Content

- Continuous-time martingales (local martingales, Doob's inequalities, Optional Stopping Theorem)
- Brownian Motion (regularity, invariance, the Dirichlet problem)
- Continuous-time Markov processes (transition semigroups, Feller property, strong Markov property)
- Poisson Processes (construction, properties, the Mecke formula)

Learning Prerequisites

Required courses

Second year mandatory courses, Probability II

Recommended courses

Measure theory

Teaching methods

Weekly lectures and problem classes

Assessment methods

Written examination in the summer session

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	Yes

Resources

Bibliography

This course is designed to be self-contained within the provided lecture notes. However, to consolidate the material and for further reading, the following references may be of use:
- Karatzas, I. and Shreve, S., 2014. *Brownian Motion and Stochastic Calculus*. Springer.
- Le Gall, J.F., 2016. *Brownian Motion, Martingales, and Stochastic Calculus.* Springer.
- Revuz, D. and Yor, M., 2013. *Continuous Martingales and Brownian Motion*. Springer.
- Ethier, S.N. and Kurtz, T.G., 2009. *Markov Processes: Characterization and Convergence*. John Wiley & Sons.
- Last, G. and Penrose, M., 2018. *Lectures on the Poisson Process*. Cambridge University Press.

Notes/Handbook

Notes will be made available in due course.

Moodle Link

- https://go.epfl.ch/MATH-354