Advanced Stochastic Processes (61212)

Instructors: M. ZAZANIS

Core Course, 2nd semester, 3.5 ECTS units

Course level: Graduate (MSc)

Language: Greek/English

Course Description

Review of useful notions from Probability Theory. Conditional Expecation. Martingales in discrete time (Filtrations, Martingales, Games of Chance, Stopping Times, Optional Stopping Theorem). Martingale Inequalities and Convergence (Doob's Martingale Inequalities, Doob's Martingale Convergence Theorem, Uniform Integrability and L1 Convergence of Martingales). Brownian Motion (Definition and basic properties, Increments of Brownian Motion, sample paths, Doob's maximal L2 Inequality for Brownian motion). Ito Stochastic Calculus (Ito Stochastic Integral: Definition, Properties of the Stochastic Integral, Stochastic Differential and Ito Formula, Stochastic Differential Equations).

Prerequisites

Probability Theory (probability measures, random variables, expectation, independence, conditional probability, laws of large numbers. Calculus (limits, series, the notion of continuity, differentiation, the Riemann integral). Basic knowledge of Lebegue Integral.

Target Learning Outcomes

- The students, after attending this course, will know the notion of martingale, which plays an important role in financial and actuarial applications.
- They will also be familiar with the Optional Stopping Theorem and Applications.
- They will be familiar with the notion of Brownian Motion, with stochastic calculus and with stochastic differential equations (with applications in various scientific fields).

Recommended Bibliography

- Z. Brzezniak, T. Zastawniak, Basic Stochastic Processes, Springer,1998.
- S. Karlin, A. M. Taylor, A Second Course in Stochastic Processes, Academic Press, 1981.

Teaching and Learning Activities

In class, assignments, presentations.

Assessment and Grading Methods

Written Examination. Assignments.