MATH0060 Stochastic Processes

Year:	2023–2024
Code:	MATH0060
Value:	15 credits (= 7.5 ECTS credits)
Term:	2
Structure:	On campus
Assessment:	50% written report, 50% oral presentation.
Normal Prerequisites:	Measure-theoretic probability theory.
Lecturer:	Prof C Marinelli

Course Description and Objectives

This is a 30-hour introductory course on stochastic calculus for continuous semimartingales with applications to continuous-time finance. Some fundamental concepts of mathematical finance will first be treated in discrete time and on a finite probability space, to avoid subtle issues typical of the general setting.

Recommended Text

None. Lecture notes will be provided.

Detailed Syllabus

Models of discrete-time finance markets on finite probability spaces: trading strategies, arbitrage opportunities, contingent claims, hedging, pricing. Equivalence between absence of arbitrage and existence of an equivalent martingale measure. Pricing by no-arbitrage.

Elements of stochastic calculus: integration with respect to continuous martingales, Ito's formula, Girsanov's theorem, stochastic differential equations with Lipschitz-continuous coefficients.

Models of financial markets in continuous time. Characterization of (a suitable notion) of no-arbitrage in terms of existence of equivalent local martingale measures. Pricing by no-arbitrage.

Portfolio optimization problems in complete markets by techniques of convex duality.

If time permits: Optimal stopping and American options. Elements of stochastic calculus for jump processes and corresponding models of asset prices.