MATH0085 (Asset Pricing in Continuous Time)

Year: 2022–2023

Code: MATH0085

Value: 15 UCL credits (= 7.5 ECTS)

Term: 1

Structure: On Campus

Assessment: 100% examination. Student must achieve at least 50% to pass this course.

Lecturer: Neofytos Rodosthenous

Course Description and Objectives

The aims of this course are to:

1. Introduce concepts of stochastic calculus in finance
2. Pricing and hedging of derivative instruments
3. Shortcomings (and proposed solutions) of the Black-Scholes model
4. Gain a solid understanding of key financial concepts from both a mathematical and financial viewpoint

Recommended Texts

Tomas Bjork, Arbitrage Theory in Continuous Time, Oxford University Press, 2004.
Steven E Shreve, Stochastic Calculus for Finance I: The Binomial Asset Pricing Model, Springer, 2004.
Steven E Shreve, Stochastic Calculus for Finance II: Continuous-Time Models, Springer, 2004. Paul Wilmott, Sam Howison & Jeff Dewynne, The Mathematics of Financial Derivatives: A Student Introduction, Cambridge University Press, 1995.

Detailed Syllabus

The course introduces the notion of no-arbitrage pricing and stochastic calculus necessary for modern financial mathematics. The pricing of financial derivatives is studied via both probabilistic and analytical methods, as well as the construction of replicating portfolios and hedging strategies. The derivation and solution of the Black-Scholes partial differential equation (PDE) are shown. Financial applications are emphasised, and shortcomings of the Black-Scholes framework are examined in detail. Extensions, including local volatility and stochastic interest rate models, are presented together with their risk-neutral pricing via the fundamental theorems of asset pricing. The Feynman-Kac connection between diffusions and PDEs is emphasised.