

Advanced Financial Models (M24)

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This course is an introduction to financial mathematics, with a focus on the pricing and hedging of contingent claims. It complements the material in Advanced Probability and Stochastic Calculus & Applications.

- *Discrete-time models.* Arbitrage, martingale deflators, the fundamental theorem of asset pricing. Numéraires, equivalent martingale measures. Forwards, options, futures, bonds, interest rates. Attainable claims, market completeness. The Breeden–Litzenberger formula. Fourier pricing. Optimal stopping.
- *Continuous-time models.* Brief survey of Brownian stochastic calculus, Itô's formula, martingale representation theorem, Girsanov's theorem. Admissible strategies. Absolute and relative arbitrage. Existence of replicating strategies. Pricing and hedging via partial differential equations. Black–Scholes model. The implied volatility surface. Dupire's formula. Stochastic volatility models.

Pre-requisites

Familiarity with measure-theoretic probability will be assumed.

Literature

1. M. Baxter & A. Rennie. *Financial calculus: an introduction to derivative pricing*. Cambridge University Press, 1996
2. M. Musiela and M. Rutkowski. *Martingale Methods in Financial Modelling*. Springer, 2006
3. D. Kennedy. *Stochastic Financial models*. Chapman & Hall, 2010
4. D. Lamberton & B. Lapeyre. *Introduction to stochastic calculus applied to finance*. Chapman & Hall, 1996
5. S. Shreve. *Stochastic Calculus for Finance: Vol. 1 and 2*. Springer-Finance, 2005

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a one-hour revision class in the Easter Term.