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MATH39032

Mathematical Modelling in Finance

Unit code:	MATH39032
Credit Rating:	10
Unit level:	Level 3
Teaching period(s):	Semester 2
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

None

Additional Requirements

Students are not permitted to take, for credit, MATH39032 in an undergraduate programme and then MATH69032 in a postgraduate programme at the University of Manchester, as the contents of the two courses overlap significantly.

Aims

Students should gain an insight into both the development and solution of the mathematical models used to describe the value of financial derivatives. As a result they should be able to find the value of basic derivatives.

Overview

This course unit is primarily concerned with the valuation of financial instruments known as derivatives. To achieve this, a mathematical model is developed and then solved for different types of problems. No previous background in finance is necessary. It is shown that mathematical methods can be powerful tools in solving financial problems once suitable models have been devised.

Assessment Further Information

End of semester examination: two hours weighting 100%

Learning outcomes

On successful completion of the course, students will be able to: apply basic ideas from classical applied mathematics to solve derivative valuation problems arising from financial modelling. Emphasis will be placed on the analogies between the financial models and physical systems.

Future topics requiring this course unit

None.

Syllabus

1. Introduction to options, futures and the no arbitrage principle - using this to calculate fair delivery prices for futures. [4 lectures]
2. Model for the movements of stock prices, efficient markets, Brownian motion and geometric Brownian motion. Stochastic and deterministic processes. [2]
3. Basics of stochastic calculus and Ito's lemma. [2]
4. The Black-Scholes analysis. Derivation of the Black-Scholes partial differential equation, the assumptions behind it. Formulating the mathematical problem, determining boundary conditions for option pricing problems. [5]
5. Solving the Black-Scholes equation. Connection with the heat conduction equation, solution of the heat conduction equation - similarity solutions and the Dirac delta function. Derivation of the price of European options. [6]
6. Extension to consider options on assets paying dividends and American options; free boundary problems. [5]

Recommended reading

- Wilmott, O., Howison, S., Dewynne, J., The Mathematics of Financial Derivatives, Cambridge University Press 1995. ISBN 0521497892

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours

- Independent study hours - 67 hours

Teaching staff

Peter Duck - Unit coordinator