

## MAS362/MAS462/MAS6053 – Financial Mathematics Autumn 2014-15

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<b>Lectures:</b>	Monday at 4pm in Hicks LT7 Wednesday at 10am in Hicks LT2
<b>Feedback sessions/Office hours:</b>	Monday 11am and Wednesday 3pm (room J16)
<b>Homework:</b>	five assignments assigned periodically

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Prerequisites:	MAS223 or equivalent (MAS221 is recommended)
Corequisites:	None
Cannot be taken with:	MAS362/MAS462/MAS6053 are mutually exclusive.

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### Aims:

The aim of this module is learn interesting applications of mathematics to the social sciences, and specifically to finance.

The first part of the module will introduce students to financial securities such as shares, bonds, forward contracts, futures and options and will raise the problem of finding their correct price. The pricing of financial securities will rely on the notion of arbitrage, i.e., the making of certain profits with no investments. Correct prices will be shown to be those which do not introduce arbitrage opportunities in markets. The first part of the course will culminate with the derivation of the Black-Scholes option pricing formulas.

The second (shorter) part of the course will deal with finding optimal investments. This will lead us to explore Portfolio Theory and finally we will describe the Capital Asset Pricing Model which gives a straightforward description of all optimal investment strategies.

### Objectives:

- (1) To understand interest rates and bonds.
- (2) To get acquainted with forward and futures contracts and their pricing methods.
- (3) To become familiar the notion of a derivative, and in particular to know the definition of European and American options.
- (4) To understand the notion of no-arbitrage pricing.
- (5) To apply the binomial tree method for approximating values of derivatives.
- (6) To understand the notion of risk neutral valuation and to derive the Black-Scholes formula and to price European options using it.
- (7) To produce feasible sets of portfolios and investor's indifference curves and to apply this for finding optimal portfolios
- (8) To understand the notion of the Market Portfolio.
- (9) To understand the beta coefficient of investments and to analyse investments using the CAPM.

## Module Format

Lectures 20	Tutorials 0	Practicals 0
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**Recommended Books** (A=core text, B= secondary text, C=background reading)

[B] P. Wilmott, "Paul Wilmott introduces quantitative finance", Wiley (2007)

[B] J. C. Hull, "Options, futures and other derivatives", Prentice Hall (1997)

[B] W. Sharpe, "Portfolio theory and capital markets", McGraw-Hill (2000)

The data-projector slides used in lectures will be available to students in advance of lectures. A summary of these will also be available.

### Assessment:

**MAS362:** One formal 2.5 hour, **closed-book** exam.  
Format: 4 out of 4 questions.

**MAS462/MAS6053:** One formal 2.5 hour, **closed-book** exam.  
Format: 4 out of 4 questions (70%).  
Project (30%)

## Detailed Syllabus

Interest rates, bonds and yield curves. (2 lectures)

Forward and Futures contracts. (3 lectures)

Options. (3 lectures)

Binomial trees and risk neutral valuation. (2 lectures)

Review of probability. (1 lecture)

The stochastic process followed by stock prices. (2 lectures)

The Black-Scholes pricing formulas. (2 lectures)

Portfolio theory. (2 lectures)

The Capital Asset Pricing Model. (3 lectures)