### COURSE DETAILS

<table>
<thead>
<tr>
<th>Course Code:</th>
<th>F71AP</th>
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<tbody>
<tr>
<td>Full Course Title:</td>
<td>Advanced Derivative Pricing</td>
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<tr>
<td>SCQF Level:</td>
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<td>SCAF Credits:</td>
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### DELIVERY LEVEL

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<th>Undergraduate:</th>
<th>Yes</th>
<th>Postgraduate Taught:</th>
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<th>Postgraduate Research:</th>
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### COURSE AIMS

The aims of this course are:

- To provide a thorough grounding in advanced topics of derivative markets
- To introduce mathematical concepts related continuous time martingales processes
- To provide students with a good understanding of developing the BSM model to different asset price models, including dividends and stochastic volatility
- To provide students with a good understanding of pricing American options
- To provide students with a good understanding of exotic options
- To introduce the student to numerical methods for pricing
- To provide students with a good understanding of modelling (the term structure of) interest rates
- To introduce the student to securitisation and credit derivatives

### LEARNING OUTCOMES – SUBJECT MASTERY

The aims of this course are:

- To provide a thorough grounding in advanced topics of derivative markets
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### LEARNING OUTCOMES – PERSONAL ABILITIES

- Show an appreciation of the interface between academic theory and industrial practice
- Demonstrate the ability to learn independently and as part of a group
- Demonstrate knowledge of computational issues
- Manage time, work to deadlines and prioritise workloads
• Present results in a way that demonstrates that they have understood the technical and broader issues of derivative pricing
• Show an appreciation of the role of derivative markets in the management of a variety of risks

SYLLABUS

Stochastic Calculus applied to financial markets

• Ito calculus, Ito's formula, statement of the Cameron-Martin-Girsanov Theorem, the concept of the Radon-Nikodym derivative, the Martingale Representation Theorem
• Self-financing portfolios in continuous time and the construction of replicating strategies using the martingale approach
• OU and Feller processes and derivation of BSM PDE
• The role of the market price of risk in the transfer between the real-world and the risk-neutral probability measures
• Hedging derivatives and the Greeks in continuous time models and structures

Exotic options and derivative portfolios

• Description of exotic options (including Quanto,Chooser, Barrier, Binary, Lookback Asian, Exchange, Basket options)
• Management of derivative portfolios of using scenario analysis.
• Risk management characteristics of certain exotic products

Stochastic Volatility

• The role of the volatility parameter in the valuation of options
• Estimation of volatility from market data
• The "smile" effect and volatility surfaces

Numerical methods

• Finite differences and lattices
• Trinomial trees
• Monte Carlo techniques
• Least-Squares (Longstaff-Schwartz) approach for American options

Modelling the Term Structure of Interest Rates

• The Black, Hull & White Vasicek and Cox-Ingersoll-Ross models (Ho & Lee, Black, Derman & Toy, Black &
Karasinski)

- HJM framework.
- Libor Market Models
- Implementation and calibration of models

Structured Derivatives and Synthetic Securities

- Products for hedging non-financial risks
- Securitisation
- Credit risk
- CDOs and CDSs

COURSE RELATIONSHIPS

<table>
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<tr>
<th>Course Code</th>
<th>Level</th>
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<td>School of Math and Comp Sci.</td>
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LOCATION AND ASSESSMENT METHODS

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Re-assessment in next academic year.