F71AP Advanced Derivative Pricing

COURSE DETAILS
Course Code: F71AP
Full Course Title: Advanced Derivative Pricing
SCQF Level: 11
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: Yes
Postgraduate Taught: Yes
Postgraduate Research: No
Additional Information:

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
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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**

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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.