COURSE DETAILS
Course Code: F70DP
Full Course Title: Advanced Derivative Pricing
SCQF Level: 10
SCAF Credits: 15
Available as Elective: No

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

COURSE AIMS

The purpose of this module is to introduce students to advanced and practical topics in derivative markets, which are essential preparation for a career in the financial industry.
**LEARNING OUTCOMES – SUBJECT MASTERY**

On completion of the course the student should be able to:

- Describe the difference between an exchange-traded and an over-the-counter (OTC) derivative, and describe the advantages and disadvantages of each;
- Be able to classify exotic options according to their path dependency, time dependence, order, dimensionality and decision structure;
- Demonstrate a knowledge of the Girsanov Theorem and how it is used in the change of probability measure;
- Calculate the price of a vanilla barrier option and a simple lookback option, and calculate their Greeks;
- Demonstrate a knowledge of the different methods that can be used to price American options including the Longstaff-Schwartz least-squares Monte-Carlo approach;
- Describe and apply the Longstaff-Schwartz least-squares Monte-Carlo approach for pricing an American option;
- Describe and apply appropriate numerical methods for pricing other exotic options including Asian options and basket options;
- Demonstrate a knowledge of the different frameworks that can be used to describe the dynamics of the term structure of interest rates;
- Show how the Hull-White model can be used to generalise the Vasicek model and how it can be implemented
- Describe and apply Black's formula for pricing interest-rate derivatives
- Show how to value interest-rate derivatives using a change of measure to the forward measure
- Describe and apply the LIBOR market model for pricing caplets and other derivatives
- Describe and apply the swaps market model for pricing swaptions
- Discuss the role of model risk in interest-rate modelling
- Discuss the accuracy of the individual assumptions underpinning the Black-Scholes model and show the failure of individual assumptions leads to market incompleteness
- Discuss how market incompleteness arises in a variety of models
- Explain why market incompleteness means there might not be a unique risk-neutral price for a derivative
- Explain how to use market information to extract a market price of risk
- Show how the market price of risk can be used to calculate market-consistent prices for new contracts

**LEARNING OUTCOMES – PERSONAL ABILITIES**

- Demonstrate the ability to learn independently and as part of a group
- 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 advanced interest-rate modelling and derivative pricing.

**SYLLABUS**

- Exchange-traded versus over-the-counter options
- American options
- Numerical methods for pricing American options
- Exotic options; different types
- Methods for pricing exotic options
- Interest-rate models: Black's formula, short-rate models; market models
- Pricing caplets and swaptions
- Review of Black-Scholes assumptions and their validity in the real world
F70DP Advanced Derivative Pricing

- Reasons for market incompleteness and implications
- Market price of risk
- Examples of market incompleteness

| COURSE RELATIONSHIPS | | | | |
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| Course Code | Level | Title | School | Type |
| F70CF | 10 | Continuous-Time Finance | School of Math and Comp Sci. | Linked |
| F79DF | 9 | Derivative Markets and Discrete Time Finance | School of Math and Comp Sci. | Pre-Requisite |
| F79SP | 9 | Stochastic Processes | School of Math and Comp Sci. | Pre-Requisite |

| LOCATION AND ASSESSMENT METHODS | | | | |
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| Edi | SBC | Ork | Dub | Malay | IDL | COLL | ALP | OTH | Method | Weight | Exam Mins | Type | Diet | Synoptic Course |
| Y | | | | | | | | | Examination | 70 | 120 | Assessment | Semester 2 |
| Y | | | | | | | | | Coursework | 30 | | Assessment | Semester 2 |