**COURSE DETAILS**

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

**DELIVERY LEVEL**

<table>
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<tr>
<th>Undergraduate</th>
<th>Postgraduate Taught</th>
<th>Postgraduate Research</th>
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<td>Yes</td>
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**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

<table>
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<tr>
<th>Course Code</th>
<th>Level</th>
<th>Title</th>
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<td>10</td>
<td>Continuous-Time Finance</td>
<td>School of Math and Comp Sci.</td>
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<td>F79DF</td>
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<td>Derivative Markets and Discrete Time Finance</td>
<td>School of Math and Comp Sci.</td>
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<td>F79SP</td>
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<td>Stochastic Processes</td>
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### LOCATION AND ASSESSMENT METHODS

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