COURSE AIMS

To introduce students to the workings of the markets in financial derivatives and to some of the basic mathematical models used to price and hedge financial derivatives in discrete time.

LEARNING OUTCOMES – SUBJECT MASTERY

- Understanding, Knowledge and Cognitive Skills Scholarship, Enquiry and Research (Research Informed Learning)
- On completion of the course the student should be able to:
  - Understand the characteristics and uses of derivative securities in financial markets;
  - Compare and contrast the features of the main derivatives contracts.
  - Understand the main uses of derivatives in hedging, arbitrage and speculation.
  - Calculate fair prices of forward contracts.
  - Demonstrate an awareness of the practical aspects involved in the trading of derivatives contracts.
  - Understand put-call parity, gearing, and the dependence of option prices on underlying variables;
  - Describe the binomial (CRR) model;
  - Describe what is meant by an arbitrage-free market;
  - Understand the concepts of replication, hedging, and delta hedging in the context of the binomial model;
  - Understand the role of the risk-neutral probability measure as a computational tool;
  - Define a discrete-time martingale;
  - Demonstrate how the existence of a martingale measure proves the absence of arbitrage;
  - Calculate prices of European call and put options using the binomial model;
  - Prove the convergence of the price of a European call or put option to the Black-Scholes formula;
  - Calculate the price an American put option under the binomial model using backwards recursion;
  - Show how the replication argument breaks down when the trinomial model is used in place of the binomial model, and how the market can be completed by the inclusion of an additional risky asset
  - Describe the different types of commodities that can be traded and their associated derivatives contracts;
  - Describe how the pricing of a forward contract on a commodity differs from an equity forward contract and show how to incorporate the convenience yield and storage costs.

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 derivatives markets and pricing and hedging derivatives
F79DF Derivative Markets and Discrete Time Finance

SYLLABUS

- Forward contracts, European and American options, over-the counter and exchange-traded derivatives
- Options: basics, strategies and profit diagrams
- Properties of derivative prices: forward pricing with and without dividends, put-call parity
- Futures contracts
- The binomial model for stock prices
- Pricing European-style derivative contracts using binary trees and the binomial model
- The risk-neutral probability measure
- Pricing American options using the binomial model
- The trinomial model for stock prices
- Commodities; forward contracts; convenience yield and storage costs.

COURSE RELATIONSHIPS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Level</th>
<th>Title</th>
<th>School</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>F78AB</td>
<td>8</td>
<td>Actuarial and Financial Mathematics B</td>
<td>School of Math and Comp Sci.</td>
<td>Pre-Requisite</td>
</tr>
<tr>
<td>F78PA</td>
<td>8</td>
<td>Probability and Statistics A</td>
<td>School of Math and Comp Sci.</td>
<td>Pre-Requisite</td>
</tr>
<tr>
<td>F79PA</td>
<td>9</td>
<td>Portfolio Theory and Asset Models</td>
<td>School of Math and Comp Sci.</td>
<td>Assessed</td>
</tr>
</tbody>
</table>

LOCATION AND ASSESSMENT METHODS

<table>
<thead>
<tr>
<th>Edi</th>
<th>SBC</th>
<th>Ork</th>
<th>Dub</th>
<th>Malay</th>
<th>IDL</th>
<th>COLL</th>
<th>ALP</th>
<th>OTH</th>
<th>Method</th>
<th>Weight</th>
<th>Exam</th>
<th>Type</th>
<th>Diet</th>
<th>Synoptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Examination</td>
<td>70</td>
<td>120</td>
<td>Assessment</td>
<td>Semester 2</td>
<td>F79PA</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coursework</td>
<td>30</td>
<td></td>
<td>Assessment</td>
<td>Semester 2</td>
<td>F79PA</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Examination</td>
<td>100</td>
<td>120</td>
<td>Reassessment</td>
<td>Semester 3</td>
<td>F79PA</td>
</tr>
</tbody>
</table>