Subject Description Form

Subject Code	AMA535
Subject Title	Mathematics of Derivative Pricing
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA528 Probability and Stochastic Models
Objectives	To teach students the basic theory and mathematical techniques for pricing financial options and other derivative securities.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Apply the no-arbitrage principle to provide estimates of derivative prices and properties. Price forward and futures contracts. (b) Use the Binomial tree model to price both European and American type options, and price elementary interest rate products. (c) Grasp the basic properties of Brownian motion, apply Ito's lemma and solve stochastic differential equations. (d) Price stock derivatives and interest rate products in the Black-Scholes framework. (e) Control risk via hedging of Greek letters.
Subject Synopsis/ Indicative Syllabus	Review of bonds, options, forwards, futures, and other derivative securities and the trading market of these assets. Principle of no arbitrage, self-financing strategies, efficient market, complete market. Pricing of forward and futures contracts. Properties of options, relationships between put and call options. Option pricing in discrete-time: binomial tree model. Elementary stochastic calculus, geometric Brownian motion, Ito's lemma. Option pricing in continuous-time: Black-Scholes formula, and risk-neutral pricing theory. Greek letters: Delta, Theta, Gamma, Vega, Rho, and hedging of them. Stochastic interest rate models: Black-Derman-Toy model, Ho-Lee model, Vasicek model, Cox-Ingersoll-Ross model, Hull-White model. Behavioral finance models in asset pricing.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of mathematical techniques and how the techniques can be applied to solving problems. Students are encouraged to adopt a deep study approach by employing high level cognitive strategies, such as critical and evaluative thinking, relating, integrating and applying

<table>
<tr><td></td><td>theories to practice.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>1. Assignments</td><td>12%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Mid-term Test</td><td>28%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>3. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
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Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.
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<tr><td>Student Study Effort Required</td><td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment/Mini-project</td><td>35 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>63 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>137 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>
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<tr><td>John Hull</td><td>Options, Futures, and Other Derivatives</td><td>Prentice Hall, 2009</td></tr>
<tr><td>Bernt Ø ksendal</td><td>Stochastic Differential Equations: An Introduction with Applications (Universitext)</td><td>Springer, 2014</td></tr>
<tr><td>Steven Shreve</td><td>Stochastic Calculus for Finance I: The Binomial Asset Pricing Model</td><td>Springer, 2004</td></tr>
<tr><td>Steven Shreve</td><td>Stochastic Calculus for Finance II: Continuous-Time Models</td><td>Springer, 2010</td></tr>
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