

**City University of Hong Kong  
Course Syllabus**

**offered by Department of Economics and Finance  
with effect from Semester A 2017/18**

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**Part I Course Overview**

<b>Course Title:</b>	<b>Quantitative Methods in Finance</b>
<b>Course Code:</b>	<b>EF4523</b>
<b>Course Duration:</b>	<b>1 Semester</b>
<b>Credit Units:</b>	<b>3</b>
<b>Level:</b>	<b>B4</b>
<b>Proposed Area:</b> <i>(for GE courses only)</i>	<input type="checkbox"/> Arts and Humanities <input type="checkbox"/> Study of Societies, Social and Business Organisations <input type="checkbox"/> Science and Technology
<b>Medium of Instruction:</b>	<b>English</b>
<b>Medium of Assessment:</b>	<b>English</b>
<b>Prerequisites:</b> <i>(Course Code and Title)</i>	<b>CB3410 Financial Management or FB3410 Financial Management &amp; EF4520 Principles of Option Pricing</b>
<b>Precursors:</b> <i>(Course Code and Title)</i>	<b>Nil</b>
<b>Equivalent Courses:</b> <i>(Course Code and Title)</i>	<b>Nil</b>
<b>Exclusive Courses:</b> <i>(Course Code and Title)</i>	<b>Nil</b>

## Part II Course Details

### 1. Abstract

This course aims to introduce the basic option pricing in continuous-time settings, elements of numerical analysis and their applications in financial engineering. Key topics include stochastic calculus, fundamental pricing theory with different numeraires, risk-neutral pricing, Black-Scholes model, numerical methods for PDEs, binomial trees and Monte Carlo simulation.

In addition to acquiring mathematical skills and training in option pricing, students will strengthen their discovery skills as they apply theories related to real life investment situations, analysis of arbitrage opportunities, and hedging portfolio with Greeks. Students are also required to implement basic VBA programs in the Excel environment when they conduct option pricing.

### 2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs <sup>#</sup>	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Identify the basic mathematical and financial concepts and tools to derive pricing equations (PDEs or ODEs)	18.5%		√	√
2.	Analyze elementary risk neutral pricing in continuous-time models	18.5%		√	√
3.	Identify the basic issues and framework of computation in financial engineering	23.5%	√	√	
4.	Master the basic numerical approaches for partial differential equations (PDEs)	17.5%		√	√
5.	Apply the numerical methods to implement derivative pricing models through using optimal algorithms and computer programming	22%	√	√	√
		100%			

\* If weighting is assigned to CILOs, they should add up to 100%.

<sup>#</sup> Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

### 3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lectures	Class discussions lead students to design models that match the theoretical framework with real markets.	√	√	√	√	√	3 hours lecture per week
Assignments	Class discussions motivate students to discover new and innovative insights on the two valuation approaches.	√	√	√	√	√	
Projects	Class discussions encourage students to explore the use of the pricing methods for real-world contingent claims.			√	√	√	

### 4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 50%							
Project			√	√	√	20%	
Assignments	√	√	√	√	√	20%	
Attendance	√	√	√	√	√	10%	
Examination: 50% (duration: 2 hours, if applicable)							
Final Examination	√	√	√	√	√	50%	
						100%	

\* The weightings should add up to 100%.

**5. Assessment Rubrics**

*(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)*

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
Final Examination	Demonstrate the capability of mastering theories and a variety of derivatives models and the capability of applying them in managing the risk of financial assets.	Demonstrate very strong knowledge in derivatives pricing, a superior grasp of the critical issue, and strong capability in making the connection with different pricing schemes.	Demonstrate good knowledge in derivatives pricing, a good grasp of the critical issue, and adequate capability in making the connection with different pricing schemes.	Demonstrate adequate knowledge in derivatives pricing, some knowledge of the critical issue, and sign of awareness of using different pricing schemes.	Demonstrate marginal knowledge in derivatives pricing, limited knowledge of the critical issue, and no awareness of using different pricing schemes.	Demonstrates very little knowledge in derivatives pricing, no awareness of the critical issue and the use of different pricing schemes.
Project						
Assignments						
Attendance						

**Part III Other Information** (more details can be provided separately in the teaching plan)

**1. Keyword Syllabus**

Elementary stochastic calculus, risk-neutral pricing, Black-Scholes model, ordinary and partial differential equations, finite difference approximations, Monte Carlo simulation, implementations of derivative pricing models.

**2. Reading List**

**2.1 Compulsory Readings**

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

1.	A Course in Derivative Securities: Introduction to Theory and Computation, by Kerry Back, Springer (martingale or risk-neutral approach).
2.	Paul Wilmott Introduces Quantitative Finance, by Paul Wilmott, Wiley (PDE approach).
3.	Options, Futures, and Other Derivatives, by John C. Hull, Prentice Hall.
4.	Dynamic Hedging: Managing Vanilla and Exotic Options, by NN Taleb, Wiley (less technical, popular among options traders).
5.	Fixed Income Securities: Tools for Today's Markets, by Bruce Tuckman and Angel Serrat, Wiley (introduction to fixed income).

**2.2 Additional Readings**

*(Additional references for students to learn to expand their knowledge about the subject.)*

<b>Online Resources</b>	
1.	<a href="http://www.wilmott.com">www.wilmott.com</a>
2.	<a href="http://www.quantcode.com">www.quantcode.com</a>
3.	<a href="http://www.quantlib.org">www.quantlib.org</a>