City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_22_ / _23_

Part I Course Overview

Course Title:	**Mathematical Finance**
Course Code:	**MA4529**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**B4**
Proposed Area: *(for GE courses only)*	☐ **Arts and Humanities** ☐ **Study of Societies, Social and Business Organisations** ☐ **Science and Technology**
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**MA3521 Introductory Mathematical Finance**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course provides fundamental concepts of probability theory, stochastic processes and option pricing. It helps students understand the mathematical concepts of stochastic processes and apply the knowledge to a range of problems in finance.

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[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	explain clearly concepts from advanced probability and stochastic processes.	15%	✓		
2.	formulate financial phenomena in terms of Brownian motions and stochastic processes.	15%	✓	✓	
3.	describe basic principles of quantitative finance, including no arbitrage and risk hedging.	20%		✓	✓
4.	derive and solve the Black-Scholes equation and apply the Black-Scholes formula in pricing vanilla options.	15%		✓	
5.	apply mathematical methods in deriving analytic relations among financial variables and analyse the pricing of exotic options.	15%		✓	✓
6.	the combination of CILOs 1-5	20%	✓	✓	✓
		100%			

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

[#] 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 self-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	6	
Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓	✓	✓	39 hours in total
Take-home assignments	Learning through **take-home assignments** helps students understand advanced probability theory, stochastic processes, principles of quantitative finance	✓	✓	✓	✓	✓		after-class

	and simple applications in modeling financial markets.							

4. Assessment Tasks/Activities (ATs)

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

30% Coursework

70% Examination (Duration: 3 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: _30___%								
Test	✓	✓	✓				20%	Questions are designed for the first part of the course to see how well the students have learned concepts of advanced probability, stochastic processes and mathematical principles of financial economics.
Hand-in assignments	✓	✓	✓	✓	✓		10%	These are skills based assessment to help students understand advanced concepts of probability, stochastic processes and some applications in quantitative finance and option pricing.
Formative take-home assignments	✓	✓	✓	✓	✓		0%	The assignments provide students chances to demonstrate their achievements in applying concepts of mathematical finance learned from this course.
Examination (duration: 3 hrs)	✓	✓	✓	✓	✓	✓	70%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in probability theory, stochastic processes and principles of mathematical finance.
** The weightings should add up to 100%.*							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)
1. Test	Ability in problem solving	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Understanding of concepts and applications	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	Study attitude	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Comprehensive ability in independent problem solving	High	Significant	Moderate	Basic	Not even reaching marginal levels

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

1. Keyword Syllabus

(An indication of the key topics of the course.)

Contracts, Vanilla options, American type options, exotic options, put-call parity, no arbitrage, game theory, replicating portfolio, risk-free portfolio, binomial trees, martingale methods, Black-Scholes formulas, Itô's lemma, stochastic derivatives, hedging portfolio.

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.	John C. Hull, Options, Futures, and other Derivatives, Prentice Hall.
2.	Paul Wilmott, Sam Howison, and Jeff Dewynne, The Mathematics of Financial Derivatives, Cambridge University Press.
3.	
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2.2 Additional Readings

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

1.	Rüdiger U. Seydel, Tools for Computational Finance, Springer.
2.	
3.	
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