MA4529: MATHEMATICAL FINANCE

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Mathematical Finance

Subject Code
MA - Mathematics
Course Number
4529

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA3521 Introductory Mathematical Finance

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain clearly concepts from advanced probability and stochastic processes.	15	x		
2	formulate financial phenomena in terms of Brownian motions and stochastic processes.	15	x	x	
3	describe basic principles of quantitative finance, including no arbitrage and risk hedging.	20		x	x
4	derive and solve the Black-Scholes equation and apply the Black-Scholes formula in pricing vanilla options.	15		x	
5	apply mathematical methods in deriving analytic relations among financial variables and analyse the pricing of exotic options.	15		x	x
6	the combination of CILOs 1-5	20	x	x	x

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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6	39 hours in total
2	Take-home assignments	Learning through take-home assignments helps students understand advanced probability theory, stochastic processes, principles of quantitative finance and simple applications in modeling financial markets.	1, 2, 3, 4, 5	after-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Test/Midterm	1, 2, 3	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.
2	Hand-in assignments	1, 2, 3, 4, 5	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.
3	Formative take-home assignments	1, 2, 3, 4, 5	0	The assignments provide students chances to demonstrate their achievements in applying concepts of mathematical finance learned from this course.

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Additional Information for ATs

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 Rubrics (AR)

Assessment Task

1. Quizzes/Test/Midterm

Criterion

Ability in problem solving

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2. Hand-in assignments

Criterion
Understanding of concepts and applications

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Formative take-home assignments

Criterion
Study attitude

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task

4. Examination

Criterion

Comprehensive ability in independent problem solving

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

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.

Reading List

Compulsory Readings

	Title
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.

Additional Readings

	Title
1	Rüdiger U. Seydel, Tools for Computational Finance, Springer.