

MA4529: MATHEMATICAL FINANCE

Effective Term

Semester B 2025/26

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 ("- for nil entry)	Allow Use of GenAI?
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.	No
2	Team-based Project	1, 2, 3, 4, 5	20	These are skills based assessment to help students understand advanced concepts of probability, stochastic processes and some applications in quantitative finance and option pricing.	Yes
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.	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

40% Coursework 60% Examination (Duration: 2 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. Team-based Project

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.