MA5616: FINANCIAL MATHEMATICS IN DERIVATIVE MARKETS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Financial Mathematics in Derivative Markets

Subject Code
MA - Mathematics
Course Number
5616

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This is an introductory course in financial mathematics. With this course, we provide a blend of the economics and mathematics on the topics of derivatives pricing and the related risk analysis. The content is easily accessible to all students from different disciplines to quickly grasp the essential financial concepts based on the knowledge in calculus and statistics.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain clearly financial concepts of various derivatives: forwards; swaps; vanilla/exotic options; fixed income products.	20	x		
2	formulate derivative pricing on discrete time model based on the arbitrage theory	20	x	x	
3	introduce Ito calculus to formulate risk-neutral price on continuous time model; mathematical derivation is mostly calculation based formulation, and a rigorous mathematical theory of Ito integral is not required.	20	x	x	
4	Understand Black-Scholes equation and related concepts in option Greeks and its implications in risk analysis.	20	x	x	x
5	Introduce the concept of risk measure, implement risk assessment of a given portfolio underlying a probability distribution	20	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	teaching	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5	3 hours/week
2	take-home assignments	Learning through take-home assignments helps students implement advanced theory for better understanding	1, 2, 3, 4, 5	After-class

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test	1, 2	20	
2	Hand-in assignments	1, 2, 3, 4, 5	10	

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Additional Information for ATs

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.Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving ability on risk analysis, including discrete time model, Ito calculus and Black-Scholes equation

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B, B-) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Fair

(C+, C, C-) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Marginal

(D) Demonstrates a partial understanding of the financial concepts and mathematical techniques in derivative markets and can seldom apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

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Assessment Task

2. Hand-in assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Comprehensive understanding of the financial concepts and mathematical techniques in derivative markets

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B, B-) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Fair

(C+, C, C-) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Marginal

(D) Demonstrates a partial understanding of the financial concepts and mathematical techniques in derivative markets and can seldom apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

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Assessment Task

3. Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Creativity and problem solving ability based on comprehensive understanding

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B, B-) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Fair

(C+, C, C-) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Marginal

(D) Demonstrates a partial understanding of the financial concepts and mathematical techniques in derivative markets and can seldom apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

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Assessment Task

1. Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Problem solving ability on risk analysis, including discrete time model, Ito calculus and Black-Scholes equation

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Marginal

(B-, C+, C) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

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Assessment Task

2. Hand-in assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Comprehensive understanding of the financial concepts and mathematical techniques in derivative markets

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Marginal

(B-, C+, C) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

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Assessment Task

3. Examinations (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Creativity and problem solving ability based on comprehensive understanding

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the financial concepts and mathematical techniques in derivative markets and can always apply the techniques to risk analysis

Good

(B+, B) Demonstrates a substantial understanding of the financial concepts and mathematical techniques in derivative markets and can usually apply the techniques to risk analysis

Marginal

(B-, C+, C) Demonstrates a general understanding of the financial concepts and mathematical techniques in derivative markets and can sometimes apply the techniques to risk analysis

Failure

(F) Demonstrates a little understanding of the financial concepts and mathematical techniques in derivative markets and can rarely or never apply the techniques to risk analysis

Part III Other Information

Keyword Syllabus

Arbitrage theory, Hedging, Binomial model, Ito's formula, Black-Scholes equation, Option Greeks, Value at Risk

Reading List

Compulsory Readings

	Title
1	Course materials provided

Additional Readings

	Title
1	Derivatives Markets, by R. McDonald 3rd Edition, Pearson
2	Options, Futures and Other Derivatives, by J. Hull, 11th Edition, Pearson