MA5618: STOCHASTIC ANALYSIS IN FINANCE

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Stochastic Analysis in Finance

Subject Code
MA - Mathematics
Course Number
5618

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 course aims to introduce concepts and techniques in advanced probability theory and discrete time stochastic processes, as well as their applications to the real-world financial models and risk analysis. It introduces some fundamental

concepts in Markov process, Martingales, Change of measure, and provides a needed preparation for its subsequent course “Advanced Stochastic Analysis in Finance”.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understanding the notions of martingales and Markov chains in discrete time, based on the rigorous framework of probability theory, with a view to analyzing real-world processes.	25	x		
2	Knowing how to use the no-arbitrage method of option pricing in a binomial model for various derivatives.	25	x	x	
3	Being able to express the risk-neutral pricing in terms of martingales and Markov processes, and understanding the change of measure associated with pricing of derivatives of European type.	25	x	x	x
4	Understanding the concept of stopping times, in connection with pricing of derivatives of American type, and other exotic options.	25	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	teaching	Learning through teaching is primarily based on lectures.	1, 2, 3, 4	3 hours/week
2	take-home assignments	Learning through take-home assignments helps students implement advanced theory for better understanding	1, 2, 3, 4	After-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test	1, 2	20	-	No
2	Hand-in assignments	1, 2, 3, 4	10	-	Yes

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Minimum Examination Passing Requirement (%)

30

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 stochastic analysis, including martingales and Markov process

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

Good

(B+, B, B-) Demonstrates a substantial understanding of the concepts and techniques in the stochastic analysis and can usually apply the techniques to solve financial problems

Fair

(C+, C, C-) Demonstrates a general understanding of the concepts and techniques in the stochastic analysis and can sometimes apply the techniques to solve financial problems

Marginal

(D) Demonstrates a partial understanding of the concepts and techniques in the stochastic analysis and can seldom apply the techniques to solve financial problems

Failure

(F) Demonstrates little understanding of the concepts and techniques in the stochastic analysis and can rarely or never apply the techniques to solve financial problems

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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 financial problem in terms of stochastic analysis

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

Good

(B+, B, B-) Demonstrates a substantial understanding of the concepts and techniques in the stochastic analysis and can usually apply the techniques to solve financial problems

Fair

(C+, C, C-) Demonstrates a general understanding of the concepts and techniques in the stochastic analysis and can sometimes apply the techniques to solve financial problems

Marginal

(D) Demonstrates a partial understanding of the concepts and techniques in the stochastic analysis and can seldom apply the techniques to solve financial problems

Failure

(F) Demonstrates little understanding of the concepts and techniques in the stochastic analysis and can rarely or never apply the techniques to solve financial problems

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Assessment Task

3. Examinations (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 concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

Good

(B+, B, B-) Demonstrates a substantial understanding of the concepts and techniques in the stochastic analysis and can usually apply the techniques to solve financial problems

Fair

(C+, C, C-) Demonstrates a general understanding of the concepts and techniques in the stochastic analysis and can sometimes apply the techniques to solve financial problems

Marginal

(D) Demonstrates a partial understanding of the concepts and techniques in the stochastic analysis and can seldom apply the techniques to solve financial problems

Failure

(F) Demonstrates little understanding of the concepts and techniques in the stochastic analysis and can rarely or never apply the techniques to solve financial problems

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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 stochastic analysis, including martingales and Markov process

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

Good

(B+, B) Demonstrates a substantial understanding of the concepts and techniques in the stochastic analysis and can usually apply the techniques to solve financial problems

Marginal

(B-, C+, C) Demonstrates a general understanding of the concepts and techniques in the stochastic analysis and can sometimes apply the techniques to solve financial problems

Failure

(F) Demonstrates little understanding of the concepts and techniques in the stochastic analysis and can rarely or never apply the techniques to solve financial problems

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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 financial problem in terms of stochastic analysis

Excellent

(A+, A, A-) Demonstrates a thorough understanding of the concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

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(B+, B) Demonstrates a substantial understanding of the concepts and techniques in the stochastic analysis and can usually apply the techniques to solve financial problems

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Failure

(F) Demonstrates little understanding of the concepts and techniques in the stochastic analysis and can rarely or never apply the techniques to solve financial problems

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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 concepts and techniques in the stochastic analysis and can always apply the techniques to solve financial problems

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Part III Other Information

Keyword Syllabus

Risk-neutral pricing, Martingale, Binomial model, Arbitrage, Delta Hedging

Reading List

Compulsory Readings

	Title
1	Course materials provided

Additional Readings

	Title
1	Stochastic Calculus for Finance I, by Steven Shreve, Springer; 2004th edition