# MA5618: STOCHASTIC ANALYSIS IN FINANCE

**Effective Term**
Semester A 2026/27

## 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

**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

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**Marginal**

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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**

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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

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(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

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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 |