Stochastic Processes with Applications in Finance and Actuarial Science
Fin Mod 9590A. **Course Outline**

1. Course Information

Course Information
Course Description: The aim of this course is to provide stochastic tools for financial modelling and pricing. It covers the basic theories of stochastic processes and stochastic calculus, with examples coming from finance.

Lecture Hours: Thursdays 8:30-11:30 am (WSB248), in-person.

List of Prerequisites
SS 2858A/B or equivalent and consent of instructor if you are not enrolled in the DSAS graduate programmes.

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Counselling) to enroll in it, you may be removed from this course, and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Marcos Escobar-Anel	marcos.escobar@uwo.ca	WSC 282	84106	Wed, 8-10am, WSC 282, in-person

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

3. Course Syllabus, Schedule, Delivery Mode

Course Objectives. After completing this course, students will be able to:
- understand essential elements of stochastic processes such as filtrations, conditional expectation, martingales;
- work with multidimensional Brownian motion;
- understand Ito's processes and the Ito's differentiation rule;
- show existence and uniqueness of solutions of Stochastic Differential Equations;
- understand Feynman-Kac formula and applications;
- understand Girsanov theorem and numeraire processes;
- replicate the payoff of various securities using self-financing portfolios;
- construct continuous-time models for security prices;

- price securities by risk-neutral valuation and by no-arbitrage;
- understand implied volatility, surface andvarious volatility models;
- price and hedge equity options using Black-Scholes in a continuous-time framework;
- simulate stochastic processes using Euler discretisation;
- generate MonteCarlo simulation for option pricing;
- explore stochastic interest rate models and Bond pricing.

See lecture notes for a break-down of course topics in a "table of contents" format with an approximate timeline.

Lecture Hours: Thursdays 8:30-11:30 am (WSC 248), in-person.

Classes begin: September 4, 2025
Fall Reading Week: November 3 – 9, 2025
Classes end: December 9, 2025
Exam period: December 11 – 22, 2025

4. Course Materials

The instructor will use his own set of course notes during lectures. Additional material and sources will be suggested during the course.

Students are responsible for checking the course OWL site (https://westernu.brightspace.com/) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

All course material will be posted to OWL: https://westernu.brightspace.com/.

If students need assistance with the course OWL site, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Assignments and/or Quizzes: Two assignments of equal weight (15%). Due dates: 2-Oct, and 20-Nov.
Midterms or Tests: One midterm, 25%, (combining Multiple Choice with open-Ended questions), 2 hours long on 23-October.
Final Exam: One final exam, 45%, 3 hours long. Time and place to de determined.

Evaluation: Students will be evaluated based on two assignments, one mid-term test, and a final examination. The final mark will be based on a weight of 30% for assignments, 25% for the mid-term test, and 45% for the final exam.

NO makeup test for evaluations. If you miss an evaluation (with a valid reason), the weight of the test (s) will be moved to the remaining exams.

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the

Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

6. Additional Statements

Religious Accommodation
When conflicts arise with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible, but not later than two weeks prior to the writing of the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays - https://www.edi.uwo.ca

Academic Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

General Academic Policies
The website for Registrar Services is https://www.registrar.uwo.ca/.

Use of @uwo.ca email: In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formally known as "appeals")

Policy on Request for Relief from Academic Decision:
https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Graduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/graduate_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Policy on Scholastic Offences: https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Graduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/graduate_scholastic_offence_procedure.pdf

Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is your responsibility to review and comply with these expectations.

Use of Generative AI Tools

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations.

Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**.

If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is your responsibility to seek clarification before using any AI tools in academic work.