

COURSE OUTLINES (SYLLABI) FOR GRADUATE COURSES**FM 9590A Course Outline****1. Course Information****Course Information**

Course Name: Stochastic Processes with Applications in Finance and Actuarial Science (FM 9590A)

Lecture Hours: Wednesday 8:30-9:20 (in-person, WSC248), Friday 8:30-10:20 (in-person, WSC248).

List of Prerequisites

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

Unless you have either the requisites for this course or written special permission from your Dean 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
Dr. Escobar-Anel	Marcos.escobar@uwo.ca	WSC282	519-661-2111 ext 84106	Wed, 10-11 (in person)
TA	TBD			

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

3. Course Syllabus, Schedule, Delivery Mode

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

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 and various 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.

Table of Contents and Schedule

Week	Dates	Topic	Delivery Mode (by Prof. Escobar-Anel)	Test Due.
1-2	Sept 6 – 17	Probability, Random Variables, Stochastic processes	In-person	
3	Sept 20 – 24	Quadratic Variation, Brownian Motion	In-person	
4	Sept 27 – Oct 1	Martingales	In-person	
5	Oct 4 – 8	Ito Integral	In-person	A1 due
6	Oct 11 – 15	Ito Processes, Ito's lemma	In-person	
7	Oct 18 – 22	Change of Measure	In-person	
8	Oct 25 – 29	Feynman-Kac	In-person	Midterm
9	Nov 1 – 5	Reading Week	N/A	
10	Nov 8 – 12	1 st and 2 nd FTAP	In-person	
11	Nov 15 – 19	Black-Scholes Model	In-person	A2 Due
12	Nov 22 – 26	Volatility Modeling	In-person	
13	Nov 29 – Dec 3	Simulation and Discretization.	In-person	

Classes begin: September 8, 2021;

Reading Week: November 1–7, 2021;

Classes end: December 8, 2021;

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Course Materials

Recommended Textbooks:

Tomas Bjork (2009). Arbitrage Theory in Continuous Time. Oxford University Press, Oxford.

Bingham & Kiesel (2004): Risk-neutral valuation, 2nd ed.

Note that these textbooks will only be used as a guide. The instructor will use his own set of course notes during lectures.

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) 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: <http://owl.uwo.ca>.

If students need assistance with the course OWL site, they can seek support on the OWL 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

The overall course grade will be calculated as listed below:

Assignments (2)	30 %. Equal weight, due dates: 6/Oct, and 17/Nov.
Midterm Test	25 %. 100 minutes long, closed-book, 29/October during class.
Final Exam	45 %. Three hours long, closed-book, date to be determined.

Accommodated Evaluations

Late submission of assignments will not be accepted, the student would receive 0.

A missed midterm, for valid reasons, will be reweighted toward the final exam i.e. Final Exam 70%.

If the make-up for the final is missed, the student will receive an INC and complete the task the next time the course is offered

6. Student Absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

6. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), 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,

7. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

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 e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Students are allowed to use a non-programmable calculator on quizzes, midterms, and the final exam

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

[If Remote Proctoring Software may be used in this course, including in the event of health lock-down]

Tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remoteproctoring.uwo.ca>.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.