

The Mathematics of Financial Options 2022/2023

Financial Modelling 9578A Section 001

Course Outline

1. Course Information

Course Description: The goal of this course is to introduce people to some basic financial products, their use in hedging and financing, their properties, and valuation. Securities such as bonds, puts, calls, forwards, and futures and their arbitrage relations will be discussed. Discrete-time stochastic models for securities prices will be introduced. Pricing and hedging (replication) of securities using these discrete-time models will be investigated. Martingales, risk-neutral valuation, and pricing by no-arbitrage will be covered. Black-Scholes option pricing formula and its hedging parameters and basic discrete-time interest rate models will be covered. Note that some of these topics may be omitted and others studied, as time and interests allow.

Prerequisites: Enrollment in a quantitative graduate program at UWO.

Corequisites: None

Antirequisites: None

Pre,Co-requisites Warning: 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
Prof. Marcos Escobar-Anel	marcos.escobar@uwo.ca	WSC282	84106	W 12-2pm (in-person)
TA (TBA)				

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

3. Course Syllabus, Schedule, Delivery Mode

Course Objectives and learning outcomes:

After completing this course, students will be able to:

- understand the properties of financial securities such as calls and puts.
- understand uses of these securities in hedging, trading and financing.
- assess the risk/reward of trading strategies.
- identify arbitrage opportunities and construct trading strategies to exploit them.
- replicate the payoff of various securities.
- construct discrete-time stochastic models for securities prices.
- understand properties of discrete-time stochastic processes such as conditional expectation and martingales.
- price securities by risk-neutral valuation and by no-arbitrage.
- dynamically hedge securities using discrete-time models;
- understand the difference between complete and incomplete market models.
- price and hedge equity options using Black-Scholes in a discrete-time framework.
- price exotic options involving various assets and/or path dependency.

Lecture Hours: Mondays 8:30-11:30am (WSC248), in-person.

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

Classes begin: September 8, 2022; January 9, 2023

Fall Reading Week: October 31 – November 6, 2022; February 18 – 26, 2023

Classes end: December 8, 2022; April 10, 2023

Exam period: December 10 – 22, 2022; April 13 – 30, 2023

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, affected 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

Textbook(s):

Cvitanic and Zapatero. Introduction to the Economics and Mathematics of Financial Markets. MIT Press, Cambridge Massachusetts.

Campolieti and Makarov. Financial Mathematics. A comprehensive treatment.

John Hull. Options, Futures, and other Derivatives, 8th or 9th Edition. Pearson.

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

Assignments and/or Quizzes: There will be 2 assignments of equal weight (15% each). Due dates: 10-Oct and 21-Nov.

Midterms or Tests: There will be one midterm (25%, combining Multiple Choice with open-Ended questions), 2 hours long on 24-October.

Final Exam: One final exam (45%), 3 hours long, date to be 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.

6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth 10% or more of the overall course grade:

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

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

The Student Medical Certificate is available at

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

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

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>.

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.

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 their official university address is attended to in a timely manner.

Non-Scientific calculators will be permitted on tests and exams.

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.

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/>.

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

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

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

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

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