MATHEMATICS OF FINANCIAL OPTIONS

FM 9578A

Master of Financial Economics

Western University

General Information: Fall, 2025

Instructor: Yifan Li
Office: Western Science Centre (WSC) 268
E-mail: yifan.li@uwo.ca
Office Hours: Wednesday 2:00-3:00 PM (in-person)

Classroom meeting time(s) & location(s): Wednesday 3:30-6:30 pm, Location TBD
Course website: `https://westernu.brightspace.com/d2l/login`
Program inquiries: SSC Room 4142 or mfe@uwo.ca

Course Description/Overview

This course provides a rigorous introduction to the mathematical foundations of financial derivatives valuation and hedging, developed within both discrete-time and continuous-time stochastic frameworks. Topics include securities such as bonds, futures, European and American options, together with their arbitrage relationships.

In the discrete-time setting, the course covers stochastic models for asset prices, no-arbitrage pricing, replication strategies, martingales, risk-neutral valuation, and fundamental asset pricing theorems. Special emphasis will be placed on the Cox–Ross–Rubinstein binomial model and its applications to option valuation. In the continuous-time setting, the course introduces Brownian motion, the Black–Scholes differential equation, its solution, and the resulting Black–Scholes pricing formula with hedging parameters. The detailed selection and depth of each component in a topic will be adjusted as appropriate to reflect time constraints and the overall pace of the class.

Prerequisite(s)

Enrollment in a quantitative graduate program at UWO.

Unless you have either the prerequisites 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.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

- Demonstrate an understanding of key financial concepts and the role of derivatives in hedging, trading, and financing.
- Assess risk–return trade-offs, identify arbitrage opportunities, and design effective trading strategies through their risk and reward.
- Apply mathematical formulations of stochastic models to the pricing of securities.
- Develop quantitative knowledge of option pricing and hedging methods, including Cox–Ross–Rubinstein and Black–Scholes models, with clear logic and intuition.
- Analyze advanced topics such as incomplete markets and exotic options.
- Relate theoretical models to real-world financial and economic phenomena.

Textbook and Other Learning Materials

The instructor will primarily use his own series of lecture notes. The course content is mainly based on the following textbooks:

- Jakša Cvitanić and Fernando Zapatero, *Introduction to the Economics and Mathematics of Financial Markets*. MIT Press, 2004. Publisher link
- Giuseppe Campolieti and Roman N. Makarov, *Financial Mathematics: A Comprehensive Treatment*. Chapman & Hall/CRC, 2nd edition. This text provides additional mathematical depth and detail. Publisher link
- John C. Hull, *Options, Futures, and Other Derivatives*, 10th edition or later. Pearson Education. This text provides broader financial background and conceptual context. Publisher link

For students interested in a deeper and more comprehensive mathematical treatment, the following references are strongly recommended:

- Steven E. Shreve, *Stochastic Calculus for Finance I: The Binomial Asset Pricing Model* and *Stochastic Calculus for Finance II: Continuous-Time Models*. Springer. Publisher link

Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below.

Assessment	Timing/Due Date	Weight
Assignments (3)	**Sept 28**, **Nov 10** and **Nov 24**	$8\% \times 3 = 24\%$
Midterm Test	**Oct 21** Time: 3:30–5:30 PM (in-class)	26%
Final Exam	TBA	50%

Assignments Students will have at least two-week period to complete each assignment so as to ensure enough time to engage with the material (and even explore further) in alignment with the course progress. Solution will be posted shortly after the due date of the assignment to help students better learn from their work in assignments based on their fresh memory.

Midterm Test Practice set will be provided in advance (including information on exam coverage and sample questions). Students are allowed to bring a **one-sided**, letter-sized and hand-written cheat sheet (you can also write it by hand into a tablet and print it out).

Final Exam Practice set will be provided in advance (including information on exam coverage and sample questions). Students are allowed to bring a **two-sided**, letter-sized and hand-written cheat sheet (you can also write it by hand into a tablet and print it out).

Department Policies

Policy on Academic Offences

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_grad.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).

Health and Wellness Services

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

Western
Master of Financial Economics

Accessible Education Western (AEW)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective Graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.

Statement on Gender-Based and Sexual Violence

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