Western Science

Department of Statistical and Actuarial Sciences

FM 9578A Course Outline

1. Course Information

Course Information
FM 9578A, Mathematics of Financial Options, Fall 2024,
Time: Wednesdays 9:30 a.m. to 12:30 p.m.
Location: AHB 2B04

List of Prerequisites
Enrolment in a quantitative graduate program at UWO.

Unless you have either the requisites for this course or written special permission from your Dean to enrol 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.Letitia Golubitsky	TBD@uwo.ca letitiagolubitsky@gmail.com	TBD	519-830-1656	1.Virtual on Zoom 2. In person (by appointment only)
Jiao Yiyao	yjiao63@uwo.ca	WSC 170		
Sahab Zandi	szandi@uwo.ca	WSC 204		

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

3. Course Syllabus, Schedule, Delivery Mode

Course description: Background knowledge of linear algebra, multivariable calculus (e.g., limits, differentiation, integration, and Taylor series), elementary differential equations, and probability (e.g., discrete and continuous random variables, expectation and variance, and moment-generating function) will be assumed in this course.

Topics and coverage: The goal of the course is to demonstrate the theoretical foundation of valuation and hedging of financial derivatives whose underlying variables follow discrete- and continuous-time stochastic processes. The mathematical theory necessary for pricing non-linear derivatives such as vanilla options (European payoff type) is introduced based on concepts and results from stochastic calculus for continuous Wiener processes with derivations of Itho lemma, Martingale Representation theorem, Radon-Nikodym Transform and Girsanov Theorem leading to option pricing in Merton-Black-Scholes model. The Black-Scholes-Merton differential equation and its solutions will be discussed. Hedging parameters will be derived.
Interest rates options such as caplets, swaptions and bond options will be introduced together with the Bachelier model for negative interest rates environment. The concept of no arbitrage pricing will be discussed along with the related notion of replication securities.

Binomial option pricing approach for European options and path dependent options (American payoff) following the Cox-Ross-Rubinstein discrete time binomial model will be introduced.

Linear derivatives such as futures, forwards and bonds together with bond convexity and yield curve concepts will be central to the course. Market conventions for model parameters estimations such as historical volatility, implied volatility, correlation, drift will be highlighted for various examples of asset classes traded in the fixed-income markets, equity and commodity markets and currency markets.
Note that some of the above-mentioned topics may be less emphasized depending on time constraints.

Key Sessional Dates:

Classes begin: September 5, 2024;
Fall Reading Week: October 12 – 20
Classes end: December 6, 2024;
Exam period: December 9 – 22, 2024;

Delivery mode:

In-person setting

4. Course Materials

References:

John Hull. Options, Futures, and other Derivatives. Pearson. (11th edition)
https://www-2.rotman.utoronto.ca/~hull/ofodslides/index.html (slides to be downloaded for free)

(Optional) recommended references:
1.Stochastic Calculus for Finance II, Continuous time models, Steven Shreve
2.Introduction to Quantitative Finance, Paul Wilmott
3.Cvitanic and Zapatero. Introduction to the Economics and Mathematics of Financial Markets. MIT Press, Cambridge Massachusetts

4.The complete guide to Option Pricing Formulas, Espen Gaarder Haug (includes CD with VBA code and Excel spreadsheets)

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

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

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

Grading Scheme and Assessment Dates

Midterm take home project 1 to be submitted in python/R/matlab (Fri, 25 Oct 2024) 20%
Midterm take home project 2 to be submitted in python/R/matlab (Fri, 15 Nov 2024) 20%
Final Exam (TBD Dec 2024) 60%

General information about missed coursework

If you have a conflict, please contact the instructor as soon as possible (and prior to the test). There will be no make-up tests. For those who legitimately miss a course requirement and provide the required supporting documentation, the standard practice will be that the weight of the missed course component will be reassigned to the final exam.

6. Additional Statements

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.

Academic Policies
The website for Registrar Services is https://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.

7. Academic policies

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

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, 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.

Any **non-programmable calculators** are permitted during the exam; note that mobile phones and other electronic communication devices are strictly prohibited.

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.