Western Science

Department of Statistical and Actuarial Sciences

FM3817B Optimization Methods for Financial Modelling
Course Outline – Winter 2026

1. Course Information

Lectures Tuesday (4:30-7:30 pm) in Visual Arts Centre (VAC) 100

List of Prerequisites Mathematics 1600A/B and one of Calculus 2302A/B, Calculus 2502A/B or Calculus 2402A/B

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) 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

Instructor	Contact Information
Dr. Yifan Li	**Email**: yifan.li@uwo.ca **Office:** Western Science Centre (WSC) 268 **Office Hours:** 3:00--4:00 PM (Tue, in-person) 10:30–11:30 AM (Thu and Fri, online)
Bilal Saleh Husain	**Email:** bhusain4@uwo.ca **Office Hours:** TBA

Office Hour Policies If your questions are brief (taking no more than 20 minutes), you are welcome to drop by without prior notice during the designated office hours. For longer questions or discussions, please notify the instructor (or TA) via email at least one day in advance. This ensures that time can be allocated effectively to benefit all students in need.

Contact Policies Students must use their Western (@uwo.ca) email addresses when contacting the instructor. Emails sent from non-UWO accounts will NOT be read.

The subject of your email should follow the format: **FM 3817 (insert "at most 4 words about your query")**; *failure to do so may result in a delayed response.* The instructor will endeavor to reply to individual email messages within 48 hours. For matters affecting the entire class, responses will be communicated through announcements.

3. Course Syllabus, Schedule, and Delivery Mode

Course Description An introduction to linear programming, simplex method, duality theory and sensitivity analysis, formulating linear programming models, nonlinear optimization, unconstrained and constrained optimization, quadratic programming. Applications in financial modelling (investment portfolio selection).

Delivery mode In-person setting.

Key Sessional Dates

Classes begin: January 5, 2026
Spring Reading Week: February 14–22, 2026
Classes end: April 9, 2026
Exam period: April 12–30, 2026

Course Coverage

Part One: Pertinent Elements of Mathematical Analysis

1. Open and closed sets of real numbers
2. Analysis on $\mathbb{R}^n$: distance in $\mathbb{R}^n$, bounded sets on $\mathbb{R}^n$, open balls
3. Continuity in general
4. Open sets in $\mathbb{R}^n$
5. Sequences and closed sets in $\mathbb{R}^n$
6. Compactness
7. Derivative of $f : \mathbb{R}^n \to \mathbb{R}^m$
8. Higher-order derivatives: differentiability, continuity, Jacobian, Hessian matrix
9. Convex sets and concave and convex functions

Recommended Readings:

- Simon, C.P. and Blume, L. *Mathematics for Economists.* Chapter 12 and Section 13.4; Sections 10.1-10.4; Sections 13.1-13.2; Sections 14.1-14.4 & 14.6-14.8.

Part Two: Optimization of Functions of Several Variables

1. Introduction
2. Unconstrained optimization
3. Constrained optimization

   (a) Equality constraints: Lagrange multiplier method
   (b) Inequality constraints
   (c) Mixture of equality and inequality constraints
   (d) Minimization
4. The Kuhn-Tucker Lagrangian
5. Meaning of multipliers
6. Envelope theorems

Recommended Readings:

- Simon, C.P. and Blume, L. *Mathematics for Economists.* Chapter 17 (Sections 17.1 and 17.2); Chapter 18; Chapter 19 (Sections 19.1 and 19.2).

Part Three: Theory of Linear Programming and Applications

1. Introduction
2. Separating and supporting hyperplanes
   (a) Convex sets
   (b) Separating hyperplanes theorem
   (c) Supporting hyperplanes
3. Linear programming in general
   (a) The basic linear program
   (b) Location of optimal solutions
4. Linear programming duality
5. Games
   (a) Zero-sum games
   (b) Matrix games
   (c) Existence of optimal mixed strategies
   (d) Finding the optimal mixed strategies geometrically

Recommended Readings:

- Ostaszewski, A., *Advanced Mathematical Methods.* Chapters 10, 12 and 13.

Part Four: Intro to Quadratic Programming (Portfolio Optimization Theory)

Recommended Readings:

- Cornuejols, G., and Tutuncu, R., *Optimization Methods in Finance*. Chapters 7 and 8.

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.

4. Course Materials

To keep the pace interactive during the lecture, the primary mode of instruction for this course will be through writing *on the board* (or on a tablet displayed on the screen), with occasional use of slides or summary documents (available on OWL) for additional support. Hence, attendance and interaction are key to students' success in this course. Meanwhile, the following references are recommended for reading (for more details) alongside the course progress:

A. Simon, C.P., and Blume, L. *Mathematics for Economists*. W.W. Norton & Company, 1994. Link to the publisher site

B. Ostaszewski, A. *Advanced Mathematical Methods*. Cambridge University Press, 1992. Link to the publisher site

C. Cornuejols, G., and Tutuncu, R. *Optimization Methods in Finance*. Cambridge University Press, 2006. Link to the publisher site

5. Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below.

Assessment	**Timing/Due Date**	**Weight**
Assignments (2)	**Jan 26** and **Mar 2**	16%
Midterm Tests (2)	**Feb 10** and **Mar 17** Time: 4:30–6:30 PM (in-class)	34%
Final Exam	To be determined by the Registrar's Office Duration: 3 hours	50%

Assignments Students will have a 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 Tests 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). Non-programmable calculators are permitted. *No other materials or electronic devices are allowed.*

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). Non-programmable calculators are permitted. *No other materials or electronic devices are allowed.*

General policies on the usage of AI (Artificial Intelligence) In this course, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini) is handled differently depending on the context. AI tools may be helpful for learning, but AI-generated content may contain errors or omissions. Any AI-assisted information should be treated with caution and must be critically evaluated and verified. When in doubt, consult course materials or seek help in office hours.

AI policy for the learning procedure (permitted with caution) The use of AI tools is **permitted with caution** as a learning aid. For example, AI may be used to review concepts, obtain alternative explanations, or support self-study. However, you remain fully responsible for understanding the material and verifying correctness. AI assistance should not replace independent engagement with the course content.

AI policy for assignments (prohibited) For **assignments**, the use of generative AI tools is **prohibited**. Assignments are intended to support skill development through independent work. You are expected to approach assignments by reading course materials, thinking critically, and problem-solving on your own. Work that is generated, rewritten, or materially shaped by AI tools will be treated as a *scholastic offence*.

AI policy for exams (prohibited) For **exams** (including midterms and final exam), the use of generative AI tools is **prohibited**. Unless explicitly stated otherwise in advance by the instructor, using such tools during an exam will be treated as a *scholastic offence*.

General information about missed coursework

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar.

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage.

All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests normally must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Final Exam (Defined by policy)
- Midterm 2

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments

Assignments Late submissions for assignments will not be accepted. (Assignments are designed to be manageable within the two-week period provided. This policy ensures solutions can be posted on time and the grading process runs smoothly.)

If you are unable to submit an assignment on time due to extenuating circumstances, you must request academic consideration. Upon approval, you must communicate with the instructor to choose one of the following options:

1. An extension of time to submit the assignment. (This option is unavailable if the solution has already been posted.)
2. Re-weighting the missed assignment to another assessment category (which is the final exam by default).

Midterms Makeup midterms will not be provided. If you miss a midterm, you must request academic consideration. Upon approval, the instructor will redistribute the weight of the missed midterm to another assessment category (which is the final exam by default).

Final Exam 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.

Important Contact Policies If you plan to request academic consideration in any of the circumstances mentioned above, you are expected to notify the instructor *before* the deadline (of assignments) or the scheduled time (of exams) to provide a brief explanation of your situation to make the process complete. Failure to do so may result in concerns (or even rejection) from the instructor's side.

6. Additional Statements

6.1 Religious Accommodation

When a recognized religious holiday or observance conflicts with an examination, test, or other scheduled academic obligation, students must request accommodation via the Universitys Student Absence Portal (SAP). This request should identify the conflict and specify which course component(s) (e.g. test, midterm, exam) are affected.

Students are encouraged to submit the SAP request as early as possible, but no later than two weeks before any examination, or one week before any mid-term test or quiz, to allow sufficient time for adjustment.

The SAP request serves as official notification to both the course instructor and the Academic Advising Office, in accordance with University policy:

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

The Faculty of Science considers religious accommodations as scheduling conflicts. Instructors should provide either a make-up exam or an earlier sitting of the same exam to accommodate the student.

For more information on recognized religious holidays, please visit the Diversity Calendar posted on the Equity, Diversity & Inclusion website - https://www.edi.uwo.ca

6.2 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 this link.

6.3 General Academic Policies

The website for Registrar Services is at this link.

Use of @uwo.ca email: In accordance with policy, the centrally administered e-mail account provided to students will be considered the individuals 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

Procedures on Request for Relief from Academic Decision (Undergraduate)

6.4 Scholastic 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 websites:

Policy on Scholastic Offences

Procedures on Scholastic Offences (Undergraduate)

Procedures on Scholastic Offences (Graduate)

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.

6.5 Support Services

Please visit the Science & Basic Medical Sciences Academic Advising 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 or 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 (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts, at this link.

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 this link if you have any questions regarding accommodations.

Learning-skills counsellors at **Learning Development and Success** (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.

Additional student-run support services are offered by the **USC** (https://westernusc.ca/services/).