Department of Mathematics

AM 2814A Course Outline

Mathematical Computation — Fall 2026

1. Course Information

Component	Day(s)	Time	Location
Lectures	Monday, Wednesday, Friday		
Laboratory 1	Tuesday		
Laboratory 2	Tuesday		

Academic term: Fall 2026. Delivery mode: In person. The course has three lecture hours and one laboratory hour per week. Students attend the laboratory section in which they are registered.

Prerequisites

A minimum mark of 55% in Mathematics 1600A/B. Pre- or co-requisite(s): Mathematics 2500A/B, Calculus 2402A/B, or the former Calculus 2302A/B or Calculus 2502A/B. The official Academic Calendar listing takes precedence in the event of a discrepancy.

Unless students have either the prerequisites for this course or written special permission from the Department of Mathematics to enroll in it, they may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on their academic record. This decision may not be appealed.

2. Instructor Information

Instructor	Email	Office	Office Hours / Availability
Dr. Taylor Brysiewicz	tbrysiew@uwo.ca		
Teaching Assistant	TBD	TBD	Scheduled laboratory periods; additional availability TBD

Students must use their Western (@uwo.ca) email addresses when contacting the instructor or teaching assistant and should include “AM 2814A” in the subject line. Changes to office hours and additional help opportunities will be announced through OWL Brightspace.

3. Course Syllabus, Schedule, and Delivery Mode

Official Course Description

Introduction to mathematical computation. Approximate solution of linear systems, nonlinear systems, and the initial value problem for ODEs. Matrix computations and practical computational complexity. Optimization. Contemporary applications of mathematical computation. Assignments using a computer and mathematical software are an important component of this course.

Course Overview

Many mathematical problems cannot be solved exactly, or cannot be solved exactly at a useful computational scale. This course introduces numerical algorithms for such problems, with emphasis on the mathematical ideas underlying the algorithms, their implementation in software, numerical error and convergence, and practical computational cost. The course develops methods for linear and nonlinear systems and initial value problems, and then connects these tools through optimization, homotopy continuation, and contemporary applications.

Course-Level Learning Outcomes

- describe the effects of floating-point arithmetic, numerical error, conditioning, and practical computational complexity;
- apply and compare direct and iterative methods for solving linear systems and carrying out basic matrix computations;
- formulate and solve least-squares problems arising from inconsistent or overdetermined systems;
- apply numerical methods to univariate and multivariate nonlinear equations and assess their convergence;

- approximate solutions of initial value problems for ordinary differential equations;
- explain and implement a basic predictor–corrector method for homotopy continuation;
- formulate and solve elementary optimization problems using gradient-based methods; and
- use mathematical software to implement algorithms, test and verify results, interpret computational behaviour, and communicate conclusions clearly.

Laboratory Periods

The scheduled laboratory periods are led by a teaching assistant and primarily provide support for the computational lab assignments. The teaching assistant may occasionally give a short lesson or software demonstration relevant to an assignment. Laboratory attendance is not a separately graded component, but students are strongly encouraged to use this scheduled support time.

Tentative Schedule

Week	Dates	Tentative Topic	Assessment / Note
1	Sept. 9–11	Floating-point arithmetic, numerical error, algorithms, and practical computational complexity	Classes begin Sept. 9
2	Sept. 14–18	Direct solution of linear systems	
3	Sept. 21–25	Conditioning and iterative methods for linear systems	Assignment 1 due Sept. 25
4	Sept. 28–Oct. 2	Least squares and matrix computations	No class Sept. 30
5	Oct. 5–9	Univariate nonlinear equations	Midterm: Oct. 7
—	Oct. 10–18	Fall Reading Week	No classes
6	Oct. 19–23	Multivariate nonlinear systems	Assignment 2 due Oct. 23
7	Oct. 26–30	Initial value problems	
8	Nov. 2–6	Homotopy continuation	Assignment 3 due Nov. 6
9	Nov. 9–13	Optimization and gradient descent	
10	Nov. 16–20	Optimization and gradient descent	Assignment 4 due Nov. 20
11	Nov. 23–27	Contemporary applications	
12	Nov. 30–Dec. 4	Synthesis and review	Assignment 5 due Dec. 4

Final classes on December 7 and 9 will be used for concluding examples, synthesis, and review. The order and pace of topics may be adjusted according to the needs of the class; any changes will be announced through OWL Brightspace.

Key Sessional Dates

- Classes begin: September 9, 2026
- National Day for Truth and Reconciliation: September 30, 2026 (no classes)
- Fall Reading Week: October 10–18, 2026
- Classes end: December 9, 2026
- Study Day: December 10, 2026
- December examination period: December 11–22, 2026

4. Course Materials

Textbooks and Other Learning Materials

Required textbook (free): Yaning Liu and Giray Ökten, *First Semester in Numerical Analysis with Python* (2020). Available online at https://yaningliucudenver.github.io/Numerical-Analysis-I/bookintro.html. Approximate cost: $0.

Recommended supplemental textbook: Timothy Sauer, *Numerical Analysis*, Pearson, any edition. Students are welcome to use an earlier or second-hand edition. Approximate e-book cost for the current edition: CAD $71.99; prices may vary by retailer and format.

Selected readings will be assigned from these books, and supplementary notes or examples may be posted to OWL Brightspace. The required online text uses Python for its examples, but students are not required to use Python in this course.

OWL Brightspace

Course materials, announcements, and assignment submission links will be posted to OWL Brightspace: https://westernu.brightspace.com/. Students are responsible for checking the course site regularly; it is the primary method by which information will be disseminated to the class.

Students who need assistance with OWL Brightspace may consult the OWL Brightspace Help page or contact the Western Technology Services Helpdesk at 519-661-3800 or extension 83800.

Technical Requirements

Students require regular access to a computer and an internet connection for computational work and electronic submission. They may use any suitable programming language or mathematical software for the computational lab assignments. Lecture demonstrations will primarily use Julia, but Julia is not required. Students are responsible for ensuring that their chosen software can perform the required computations and that submitted code and output are readable and reproducible. No paid software is required; all coursework can be completed using free software.

5. Methods of Evaluation

Grading Scheme and Assessment Dates

Assessment	Weight	Date
Computational lab assignments (best 4 of 5)	20%	See schedule below
Midterm test	35%	Wednesday, October 7, 2026, during class (tentative)
Cumulative final examination	45%	Scheduled by the Registrar during the December examination period

Each of the four counted computational lab assignments is worth 5% of the final course grade. The midterm will tentatively cover material through Friday, October 2. The final examination is cumulative and may assess any material covered in the course. Permitted aids for the midterm and final examination will be announced in advance.

Computational Lab Assignment Schedule

Assignment	Due date	No-late-penalty period ends	Tentative focus
1	Fri., Sept. 25, 11:59 p.m.	Sun., Sept. 27, 11:59 p.m.	Floating-point arithmetic and linear systems
2	Fri., Oct. 23, 11:59 p.m.	Sun., Oct. 25, 11:59 p.m.	Conditioning, iterative methods, and least squares
3	Fri., Nov. 6, 11:59 p.m.	Sun., Nov. 8, 11:59 p.m.	Nonlinear equations and systems
4	Fri., Nov. 20, 11:59 p.m.	Sun., Nov. 22, 11:59 p.m.	Initial value problems and homotopy continuation
5	Fri., Dec. 4, 11:59 p.m.	Sun., Dec. 6, 11:59 p.m.	Optimization and contemporary applications

The assignment topics and dates are tentative. Any necessary changes will be announced in class and through OWL Brightspace with reasonable notice.

Use of Generative AI Tools in Assessments

Generative AI tools may be used freely in completing the computational lab assignments, including for programming, debugging, mathematical problem solving, explanations, and written presentation. Students remain fully responsible for understanding and verifying everything they submit, including all code, calculations, mathematical claims, interpretations, and conclusions. They must be able to explain any part of their submitted work and may be asked to do so.

Generative AI tools are not permitted on the midterm test or final examination. Using such tools on either assessment will be treated as a scholastic offence.

Essential Learning Requirements

There are no additional essential learning requirements beyond the normal requirement of achieving a passing overall course grade.

Information about Missed Coursework

Students must familiarize themselves with the University Policy on Academic Consideration — Undergraduate Students in First Entry Programs: Academic Consideration Policy.

This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. It also does not apply to students experiencing longer-term impacts on their academic responsibilities; those students should consult Accessible Education.

Procedures for submitting Academic Consideration requests are posted by the Office of the Registrar: Academic Considerations. All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

The midterm and computational lab assignments in this course are handled automatically through the Flexible Completion rules below. Students do not submit Academic Consideration requests for these assessments. The final examination remains subject to the standard university policy.

Midterm Test: Automatic Reweighting

This course has one midterm test and a cumulative final examination. There is no makeup test for a missed midterm. If a student misses the midterm, its 35% weight will shift automatically to the final examination. If the final examination grade is higher than the midterm grade, the final examination grade will replace the midterm's weight in the overall course grade. Students do not need to request Academic Consideration for a missed midterm; the reweighting will be done automatically.

The only exception is an early sitting offered solely for a university-sanctioned schedule conflict, such as a conflict between two midterms or a varsity competition, or for a religious accommodation that prevents the student from writing at the scheduled time. A student requiring an early sitting must notify the instructor in writing no later than one week before the test. No other circumstance, including illness, qualifies for an early sitting or makeup; these circumstances are addressed through the automatic reweighting described above.

Computational Lab Assignments: Flexible Completion

This course has five computational lab assignments, and the best four submissions count toward the assignment component. A student may therefore miss one assignment without requesting Academic Consideration; the missed assignment will not count against them.

If a student completes fewer than four assignments, missing counted assignments will be recorded as zero and included in the assignment-component grade. Students are encouraged to submit all work, even if incomplete, because partial credit is preferable to a zero. In this circumstance, if the final examination grade is higher than the resulting assignment-component grade, the assignment component's 20% weight will shift to the final examination.

Deadlines: 48-Hour No-Late-Penalty Period

Each computational lab assignment has an automatic 48-hour period after its stated deadline during which it may still be submitted without a late penalty. The exact end of each no-late-penalty period is listed in the assignment schedule above. After that period, no further submissions will be accepted. Students do not need to request Academic Consideration for a missed deadline; their grade will be calculated according to the Flexible Completion rules above.

Special Examination

Per university policy, Academic Consideration requests with supporting documentation are required for final examinations scheduled during official examination periods by the Registrar's Office.

If a student has been approved by the Academic Advising Office to write a Special Examination (SPC) and the final examination is their only outstanding course component, an SPC will be assigned and scheduled by the instructor according to university policy.

If a student misses the SPC examination and is approved for Academic Consideration, they will be withdrawn from the course without academic penalty. If they experienced extenuating circumstances such as prolonged illness, they may appeal to the Associate Dean (Academic), on a case-by-case basis, for the opportunity to write the final examination the next time the course is offered. An outstanding SPC will reduce their course load for the term in which the examination is deferred, as outlined in the Definitions of Types of Examinations policy.

If a student misses the SPC examination and Academic Consideration is not approved, or was not requested, they will receive a grade of zero on the examination.

6. Additional Statements

6.1 Religious Accommodation

When a recognized religious holiday either requires a student to be absent from the University, or requires or prohibits an activity that makes it impossible for them to complete an academic requirement scheduled that day, they are entitled to accommodation. No student will be penalized for an absence for religious reasons, and an alternative means of satisfying the requirement will be arranged. This accommodation is provided in accordance with the University's policy on Accommodation for Religious Holidays.

Accommodation for Religious Holidays:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Students should submit requests through the Student Absence Portal (SAP), identifying the conflict and the specific course component affected.

Midterm test: If a religious observance conflicts with the midterm, the request must be submitted no later than one week before the test. The instructor will arrange an early sitting. As set out above, no makeup test is offered for any other reason.

Final examination: If a religious observance conflicts with the final examination, the request must be submitted no later than two weeks before the examination. The instructor will arrange a Special Examination to take place no later than one month after the end of the examination period.

Students are responsible for finding out what was covered in any class they miss because of a religious observance and for taking appropriate steps to keep up with the course. If a suitable arrangement cannot be reached with the instructor, they should consult the Undergraduate Chair of the department offering the course and, if necessary, the Associate Dean (Academic) of the Faculty of Science.

For a list of recognized religious observances, consult the calendars posted on Western's Equity, Diversity & Inclusion website: https://www.edi.uwo.ca (About Us → Resources → Additional Resources → Calendars).

6.2 Academic 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.

Academic Accommodation for Students with Disabilities:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

6.3 General Academic Policies

The website for Registrar Services is https://www.registrar.uwo.ca/.

Use of @uwo.ca email: In accordance with university policy, the centrally administered email account provided to students is considered their official university email address. Account holders are responsible for ensuring that messages received from the University at that address are attended to in a timely manner.

University Email Policy: https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf

Requests for Relief (formerly known as "appeals"):

Policy on Request for Relief from Academic Decision:
https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision — Undergraduate:
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Policy on Scholastic Offences: https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences — Undergraduate:
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

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, including tests, midterms, and final examinations, is strictly prohibited. This includes, but is not limited to, mobile phones, smart watches, smart glasses, hidden cameras, and wireless earbuds.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at a student's desk, on their person, or within reach during an assessment will be treated as a scholastic offence, even if the

device is not in use. Effective September 2026, the typical penalty for this offence is a failing grade in the course and a 12-month prohibition on retaking the course.

Only devices expressly permitted by the instructor may be brought into the assessment room. Students are responsible for reviewing and complying with these expectations.

Use of Generative AI Tools

Generative AI tools are permitted on the computational lab assignments under the conditions stated in Section 5: students must understand, verify, and be able to explain everything they submit. Generative AI tools are not permitted on the midterm test or final examination. Using such tools on an assessment where they are prohibited will be treated as a scholastic offence.

Instructor disclosure: Generative AI was used to assist in drafting this course outline. The instructor reviewed and takes responsibility for its contents.

6.5 Support Services

Academic Advising: Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding or dropping courses, academic considerations for absences, requests for relief, examination conflicts, and other academic matters: https://www.uwo.ca/sci/advising/.

Mental Health Support: Students who are in emotional or mental distress should consult Mental Health@Western for a complete list of support options: https://uwo.ca/health/.

Gender-Based and Sexual Violence: Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to survivors. Information about support services and emergency contacts is available at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or arrange an appointment, contact support@uwo.ca.

Accessibility for Coursework: Students may contact the instructor if they require lecture or printed material in an alternate format or if other arrangements could make the course more accessible. Questions about accommodations may also be directed to Accessible Education: http://academicsupport.uwo.ca/accessible_education/index.html.

Learning Development and Success: Learning-skills counsellors can help students improve time management, examination preparation, textbook reading, and related learning skills. Information is available at https://learning.uwo.ca.

Student Councils: Student-run support services are offered by the University Students' Council at https://westernusc.ca and by the Science Students' Council at https://www.westernssc.ca.

Course outline revision date: August 31, 2026