

Numerical Analysis AM2814G Winter 2025 Course Outline

1. Course Information

Course Name: Numerical Analysis AM2814G Term: Winter 2025 Instructor: Dr. Jason Bertram

List of Prerequisites

Prerequisites: A minimum mark of 55% in Mathematics 1600A/B. **Pre-or Co-requisite(s):** Calculus 2302A/B, Calculus 2402A/B or Calculus 2502A/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

Instructors	Email	Office	Office Hours
			Tues 10:30-11:30
Dr. Jason Bertram			Thurs 11:30-12:30

Students must use their Western (@uwo.ca) email addresses when contacting their instructors and must include "AM2814" in the email subject.

Office hours held in person.

3. Course Syllabus, Schedule, Delivery Mode

Official Description: Introduction to numerical analysis; polynomial interpolation, numerical integration, matrix computations, linear systems, nonlinear equations and optimization, the initial value problem. Assignments using a computer and the software package, Matlab, are an important component of this course.

Contents of course:

- 0. Numerical errors, basic computer algorithms, numerical software (selected material from Chap 0 of Sauer)
- 1. Solutions of equations in one variable (Chap 1)
- 2. Numerical methods for solving linear systems (Chap 2)
- 3. Interpolation (Chap 3)
- 4. Least Squares (Chap 4)
- 5. Numerical differentiation and integration (Chap 5)
- 6. Initial value problem for ordinary differential equations (Chap 6)

Applied problems usually can not be solved exactly and must be solved using approximate methods (numerical methods). Numerical analysis is the science of such methods, and a main goal of the course is to give you an introduction to numerical analysis. The size and complexity of such problems necessitates the use of computers to implement algorithms to solve them. Numerical analysis also involves the analysis of algorithms (their computational cost, error and convergence to solutions).

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Week	Content covered (tentative, subject to change)	
1 Jan 6-10	Lab0 (Matlab basics). Chap 0.	
2 Jan 13-17	Lab1A (Iteration). Chap 1.	
3 Jan 20-24	Lab 1B (Evaluated; due Sun Feb 26 @ 11:59pm). Chap 1.	
4 Jan 27-31	Lab 2A (Numerical equation solving) Chap 2.	
5 Feb 3-7	Lab 2B (Evaluated; due Sun Feb 9 @ 11:59pm). Chap 2.	
6 Feb 10-14	Lab 3A (Numerical linear algebra). Chap 3.	
7 Feb 17-21	Reading week	
8 Feb 24-28	Lab 3B (Evaluated; due Sun Mar 2 @ 11:59pm). Chap 4. Mid-term.	
9 Mar 3-7	Lab 4A. Chap 4	
10 Mar 10-14	Lab 4B (Evaluated; due Sun Mar 23 @ 11:59pm). Chap 5.	
11 Mar 17-21	Chap 5.	
12 Mar 24-28	Chap 6.	
13 Mar 31-Apr 4	Chap 6.	

Tentative schedule:

Course level learning outcomes: By the end of the course you should be able to numerically solve linear, nonlinear, and differential equations. You are also expected to numerically differentiate and integrate functions. Other outcomes include the ability to derive results (proofs) from an applied perspective, with less time spent on this than in a pure mathematics course. Students should be able to apply numerical analysis to problems in science and interpret the results. Since this is an essay course, another outcome is to be able to write up such analyses in the form of Lab reports.

Classes begin: January 6, 2025 Spring Reading Week: February 17 – 21, 2025 Classes end: April 4, 2025 Exam period: April 7 – 30, 2025

4. Course Materials

- **Required textbook:** Numerical Analysis, by Timothy Sauer, 3rd Edition. An Ebook is available from the bookstore for \$55 (<u>https://tinyurl.com/3tntz2xh</u>).
- It is recommended that students purchase the 3rd edition.

Some course material will also 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 <u>OWL Brightspace</u> <u>Help</u> page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

Completing the labs requires a computer with a working version of Matlab installed. Matlab is available at no cost through the Western site license (<u>https://wts.uwo.ca/sitelicense/matlab/</u>).

5. Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course gra	ade will be calculated as listed below:
Laboratories (4)	First three worth 6%. Last one worth 12%.
Midterm Test	30% (Chap 0-2).
Final Exam	40% (Date TBA. Cumulative.)

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: https://www.uwo.ca/univsec/pdf/academic policies/appeals/academic consideration Sep24.pdf,

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 <u>Accessible Education</u>.

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

https://registrar.uwo.ca/academics/academic considerations/

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

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make <u>one</u> 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 (Scheduled by the Office of the Registrar). Closed book, no electronic devices permitted.
- Midterm test. (Tentatively scheduled for Tue Feb 25 in class). Closed book, no electronic devices permitted.

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

Evaluation Scheme for Missed Assessments

Midterm

If a student is unable to attend the midterm due to extenuating circumstances, a makeup-midterm will be arranged. If the makeup is also missed due to the extenuating circumstances, the mid-term will be reweighted to the final exam.

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 <u>Special Examinations</u>), especially for those who miss multiple final exams within one examination period.

Coursework with Assessment Flexibility

By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

Deadline with a No-Late-Penalty Period

Labs: Students are expected to submit the evaluated labs by the specified deadline. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit their assignment up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 20% per day will be applied, although assignments submitted more than 96 hours past the deadline will not be accepted. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No-Late-Penalty Period. Students who receive academic consideration lasting longer than the No-Late-Penalty Period will have the weight of the relevant assignment shifted to the final exam.

6. Additional Statements

Religious Accommodation

When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

https://www.edi.uwo.ca.

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.

No electronic devices permitted in the mid-term test or final exam.

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:

https://www.uwo.ca/univsec/pdf/academic policies/appeals/scholastic discipline undergrad.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).

In the event of health lock-down, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

https://remoteproctoring.uwo.ca.

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: <u>https://www.uwo.ca/sci/courselling/</u>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<u>https://uwo.ca/health/</u>) 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 Learning Development and Success (<u>https://learning.uwo.ca</u>) 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: <u>https://www.uwo.ca/se/digital/</u>.

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