


Western University
Course Outline Applied Mathematics 2814G
Winter 2024, Numerical Analysis (revised Jan 7, 2024)


Instructor: Greg Reid

Office: MC 281



Email: reid@uwo.ca *Always include AM2814 in the subject line of emails.*

Course Web Site: <http://owl.uwo.ca>

Note on Delivery: Classes will start Monday Jan 8, 2024, and unless announced otherwise will be in person 

Instructor's Office Hour: Private (1 on 1) by appointment: Wed 2:30 pm – 3:30 pm 

It is your responsibility to regularly check the course web site daily for emails, grades, announcements, assignments, important dates etc. Note however that some announcements will be made often only in class.

Lectures: MWF 8:30 am – 9:30 am  in UCC-37 in real time. Synchronous live in the event of pivot to online .

First lecture: Mon January 9.

It is your responsibility to regularly check the course web site daily for emails, grades, announcements, assignments, important dates etc. Note however that some announcements will be made only in class.

Always include AM 2814 in the subject line of emails.

Labs (attendance required at your designated labs, roll taken, which are in person. In the event of pivot to online then the labs will be synchronous live. Quizzes will generally be given in labs)

Lab 003 Tues: 8:30 am-9:30 am NCB-105 **Lab 002** Thur: 9:30 am - 10:30 am HSB-13. First Labs Jan 9 & 11.

Required Text: Numerical Analysis, by Timothy Sauer: (print book) 3rd ed. ISBN 9780134697338. The e-Text. 3rd ed. has ISBN 9780134697369. <https://www.vitalsource.com/en-ca/products/numerical-analysis-timothy-sauer-v9780134699370>

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.

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 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 if you are dropped from a course for failing to have the necessary prerequisites.

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 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 the algorithms (their cost, error and convergence to solutions).

Course level learning outcomes: Numerical analysis is roughly the extension of the familiar real calculus and algebra to approximate data. Students are expected by the end of the course to numerically solve linear, nonlinear, and differential equations. Students 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. By the end of the 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 with attention to style and communication to a wide audience.

Attention should be paid to material from labs, lectures, text, and web site, to gain a complete view of expectations for course. Our goal is to navigate an understandable path through the material. So, some material will be omitted from the text and some material and methods when more efficient, will be given from outside the text. Over-reliance on one source is unwise: some material will be covered in the lectures that is not in the text, and in a manner sometimes different to the text.

Evaluation

Note that as an Essay Course, students are required to provide at least 2500 words/student, in connected prose (equations, computer code and references excluded) and outline an argument in connected prose. This is implemented by team members indicating which sections of prose they are responsible for on each report to a minimum of 500 words/student/Lab report. Additionally, students should provide an essay self-contained summary of their contribution to Lab4B (minimum of 600 words per student). To pass the course, each student needs to pass the essay component.

Regular Assigned Problems (not graded): see owl in Lessons/AssignedProblems

4%: Marked on participation only using iclicker. Your score is based on the % of questions you answer:

At least 80% = 4; 70–79% = 3.2; 60–69% = 2.4; 50–59% = 2; 40–49% = 1.6; Less than 40% = 0





4% – 4 quizzes Q1, Q2, Q3, Q4 (each worth 1%)

32% – Lab1B, Lab2B, Lab3B (each worth 7%) and Lab4B (worth 11%, incl. oral test & video)

20% – Midterm (as shown in the schedule)

40% – Final Exam (time TBA)

Schedule (tentative)

| Week: Dates | Schedule (tentative) Description |
|----------------------------|---|
| 1: Jan 8 – 14 | Mon Jan 8: 8:30am  [1 st lecture]. Lab0  [attend designated Lab Tu:830am/Th:930am] |
| 2: Jan 15 – 21 | Lab1A  Quiz 1 |
| 3: Jan 22 – 28 | Lab1B [Due Sun Jan 28 at 11:59pm]. Attend your designated Lab1B. |
| 4: Jan 29 – Feb 4 | Lab2A  Quiz 2 |
| 5: Feb 5 – 11 | Lab2B [Due Sun Feb 11 at 11:59pm]. Attend your designated Lab2B. |
| 6: Feb 12 – 18 | Lab3A Quiz 3 |
| Feb 17– 25 | Spring Reading Week. |
| 7: Feb 26–Mar 3 | Midterm Frid Mar 1, 7 – 10 pm (to be finalized). Progress Report on Lab3B due Mar 3 @ 11:59pm |
| 8: Mar 4 – 10 | Lab3B [Due Sun Mar 10 @ 11:59pm]. Makeup midterm Frid Mar 8, 7 – 10 pm. |
| 9: Mar 11 – 17 | Lab4A and Quiz4 + Progress Report on Lab4B due Mar 17 @ 11:59 pm |
| 10: Mar 18 – 24 | Lab4B [Due Sun Mar 24 @ 11:59pm, video+code+write-up]. |
| 11: Mar 25 – Mar 31 | Lab4B [oral questions in your Lab time]. Easter Frid Mar 29 (uwo closed). |
| 12: Apr 1 – 7 | Classes April 1,3 & 5. Any remaining presentations in Lab times (April 2&4). |
| 13: Apr 12 – 30 | Classes end Mon Apr 8. April 9-11 (Study Days). Final Exams April 12 – 30. |

iClicker In order to receive any credit for the iClicker component, you must:

- Create a free iClicker account using your Western email address. Please refer to the instructions at <https://presswestern.uwo.ca/> . If you already have an iClicker account, please go into the settings and verify that it uses your uwo.ca email address.
- Attend, and answer iClicker questions at lectures.
- If your web-enabled device is not working properly, try refreshing the page or restarting the app. It is your responsibility to ensure that your device is working properly.

Missed Lectures (iClicker Questions): We understand that you will not be able to attend class from time to time. Therefore, the participation-based iClicker marking scheme was designed to take into account the occasional missed class. Accordingly, iClicker marks will not be adjusted for the occasional missed class. If you have a long-term absence (three or more consecutive classes) that is supported by academic consideration, then your iClicker marks will be adjusted to take your long absence into account.

1. Lab related Instructions

Each part B of a lab will require a full written report (abstract, introduction, body, discussion and conclusions, references, appendices (extra code, figures etc). The report should explain what you did in the lab as well as the results you obtained. Because this is an essay course you will be graded on code style, writing style, grammar, spelling, etc. You will be put in teams of 2. The same team throughout the term, team members must belong to the same lab time (penalty for submitting in the wrong lab time). Lab 4B is an extended project lab; and a video presentation and oral questions will be part of the assessment for that lab.

When submitting your part B write up along with the code from part B you will be required to submit a digital copy of your write up and code on Gradescope. You will submit a pdf copy of your write up and code online to Gradescope (further submission instructions will be given later). Some of your programs will be automatically graded e.g. via Gradescope's Autograder. Grades will be deducted if instructions are not followed. Note that all Labs must be submitted, accommodations are only offered for delaying the hand in date (via UWO accommodations process).

Late Marks: N*20% deducted for up to N = 1, 2, 3, 4, 5 days late

2. Technical Requirements:



Stable internet connection



Laptop or computer with [MATLAB installed](#)



Working microphone



Working webcam

Also required: Licenses for **Gradescope's Autograder**.

If students need assistance, they can seek support on the [OWL Help page](#). Alternatively, they can contact the [Western Technology Services Helpdesk](#). They can be contacted by phone at 519-661-3800 or ext. 83800. [Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).

3. Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Additional comments on Course Materials

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. As well, students should regularly consult the Gradescope site associated with the course.

All course material will be posted to OWL: <http://owl.uwo.ca>. and on Gradescope.

If students need assistance with the course OWL site, they can seek support on the OWL 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. Other notes on Methods of Evaluation

As per policy, take-home examinations may be scheduled only with permission of the Dean of the Faculty offering the course to ensure that the examination plans will not unduly interfere with the students' ability to write their other exams.

6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth less than 10% of the overall course grade:

Note that all Labs must be submitted, accommodations are only offered for delaying the hand in date (via UWO accommodations process). Note that in all cases where documentation (medical or otherwise) is required, it can *only* be collected by the student's Dean's Office Academic Counselling unit.

Assessments worth 10% or more of the overall course grade:

By policy, academic considerations for work totalling 10% or more of the final course grade can be granted only by the student's Faculty of Registration (typically by their academic counsellors). In such cases, students should be directed as follows.

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

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

The Student Medical Certificate is available at

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

Absences from Final and Midterm Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). Makeups for the final exam and midterm and only with the appropriate documentation and approvals by UWO's process.

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

Note: missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

6. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday from the course instructor. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

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.

7. Academic Policies

The website for Registrarial Services is <http://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.

Electronic Devices on Quiz, Tests and Exams: Instructions for each assessment will be specific to the assessment about use of electronic devices. On the Midterm & Final only the Sharp EL510RTB calculator will be allowed. See

<https://www.staples.ca/products/437262-en-sharp-el510rtb-scientific-calculator-white>

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.

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>).

[If Remote Proctoring Software may be used in this course, including 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**. You will need 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>.

Note: use of online proctoring for in-person courses requires approval from the Dean's Office.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling 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/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 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 the Student Development Centre (<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.

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: <https://www.uwo.ca/se/digital/>.

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