Western University
Course Outline Applied Mathematics 2814G
Winter 2022, Numerical Analysis (revised Jan 09, 2022)

Instructor: Greg Reid   **Office:** MC 281 (usually out in January, due to Covid restrictions)

Email: reid@uwo.ca   *Always include AM 2814 in the subject line of emails.*

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

Note on Delivery: As of Dec 21, 2021, classes will start Monday Jan 10, 2022, and be online until the end of Jan. Delivery (online or in person) after January is still uncertain.

: Below means online (in Jan) and will be determined (in person or by online) depending on public health and UWO guidelines after January.

Instructor's Office Hour: Private (1 on 1) by appointment: Mon 9:30 am – 10:30 am

Note I will usually be available at the end of the Wednesday and Friday classes

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 usually in real time, i.e. synchronous live if online.

First lecture: Mon January 10.

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, synchronous live if online, Quizzes will be given in labs)
Lab 003   Tues: 8:30 am-9:30 am   **Lab 002**   Thur: 9:30 am - 10:30 am. First Labs Jan 11 & 13 (Labs live online in Jan)

Required Text: Numerical Analysis, by Timothy Sauer: (print book) 3rd ed. ISBN 9780134697338. The e-Text. 3rd ed. has ISBN 9780134697369.

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. **Antirequisite(s):** AM2413 or the former AM2813B Pre-or **Co-requisite(s):** Calculus 2302A/B, Calculus 2402A/B or Calculus 2502A/B.

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 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
Regular Assigned Problems (not graded): see owl in Lessons/AssignedProblems
8% – 4 quizzes Q1, Q2, Q3, Q4 (each worth 2%)
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)

Comments: Quizzes will be equally weighted. Makeups for the final exam and midterm and only with the appropriate documentation and approvals by UWO's process.

Note that since Labs extend over 2 weeks, an SRA (applicable to a 48 hour period) can not be used as justification for not doing a Lab.

Schedule (tentative)

Week: Dates	Schedule (tentative) Description
1: Jan 10 – 16	Mon Jan10: 8:30am [1st lecture]. Lab0 [attend designated Lab Tu:830am/Th:930am]
2: Jan 17 – 23	Lab1A [Quiz1 online in your Lab time]. Live synchronous Lab1A
3: Jan 24 – 30	Lab1B [Due Sun Jan 30 at 11:59pm]. Attend your designated Lab1B.
4: Jan 31 – Feb 6	Lab2A [Quiz2 in your Lab time]. Live synchronous Lab2A
5: Feb 7 – 13	Lab2B [Due Frid Feb 13 at 11:59pm]. Attend your designated Lab2B.
6: Feb 14 – 20	Lab3A [Quiz3 in Lab time].
Feb 19 – 27	Spring Reading Week.
7: Feb 28–Mar 6	Midterm Frid Mar 4, 7 – 10 pm (to be finalized). Progress Report on Lab3B due Mar 6 @ 11:59pm
8: Mar 7 – 13	Lab3B [Due Sun Mar 13 at 11:59pm].
9: Mar 14 – 20	Lab4A and Quiz4 + Progress Report on Lab4B due Mar 20 @ 11:59 pm
10: Mar 21 – 27	Lab4B [Due Sun Mar 28 at 11:59pm, video+code+write-up].
11: Mar 28 – Apr 2	Lab4B [oral questions in your Lab time].
12: Apr 4 – 8	Last week of classes, Last class Frid Apr 8) + remaining presentations in Lab times.
13: Apr 9 – 30	**Final Exams April 10 – 30.** Sat April 9 (Study Day), Easter Friday Apr 15 (Official Holiday)

Lab related Instructions

Each part B of a lab will require a full written report (abstract, introduction, body, discussion and conclutions, 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. In particular 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 SRA or UWO accommodations process).

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

Technical Requirements:

	Stable internet connection		Laptop or computer with MATLAB installed
	Working microphone		Working webcam

Also required: Licenses for **Gradescope's Autograder**
- more info in the first week of classes.

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.

1. Western Academic Policies and Statements

Absence from Course Commitments

Policy on Academic Consideration for Student Absences

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,

- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**
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Accommodation for Religious Holidays

The policy on Accommodation for Religious Holidays can be viewed here.

Special Examinations

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found here.

Academic Offenses

"Scholastic offences are taken seriously, and students are directed here to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review The policy on Accommodation for Students with Disabilities.

Correspondence Statement

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. You can read about the privacy and security of the UWO email accounts here.

2. **BMSUE Academic Policies and Statements**

Copyright and Audio/Video Recording Statement

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

Tests and examinations in this course will be conducted using the remote proctoring service, including Proctortrack.

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**. More information about these remote proctoring services are available at:

https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf

Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for these services. Information about the technical requirements are available at the following link:

https://www.proctortrack.com/tech-requirements/

Use of Recordings

Some remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

3. **Support Services:** The following links provide information about support services at Western University.

> Academic Counselling (Science and Basic Medical Sciences)
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> Appeal Procedures
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> Registrarial Services
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> Student Development Services
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> Student Health Services

4. **Addendum to all Mathematics Course Outlines**

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will 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.

For multiple-choice tests and/or exams: Use may be made of software to check for unusual coincidences in answer patterns that may indicate cheating.

5. **Accreditation (AU) Breakdown:** Engineering Science = 100%