Western University
Course Outline Applied Mathematics 2814G
Winter 2021, Numerical Analysis

Instructor: Greg Reid   **Office:** MC 281 (usually out due to COVID restrictions)

Email: reid@uwo.ca

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

Instructor's Office Hour: Private (1 on 1) Zoom by appointment: Mon 4 pm – 5 pm.

Note I will usually be available at the end of each class, for group chat by Zoom 10:30 am – 11 am

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 AM2814 in the subject line of emails.

Lectures: M W F (9:30 am -10:30 am, live synchronous online, recorded). For Zoom lecture links check OWL.

Labs (attendance required at your designated labs, roll taken, synchronous 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 12 & 14 Jan (Intro to Matlab)

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 computations because of their size and complexity must use computers to implement algorithms and understand the behavior of the algorithms (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. Thus, 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 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. For example, 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
10% – 5 quizzes Q1A, Q2A, Q3A, Q4A, Q5A (as shown in the schedule)
30% – Lab1B, Lab2B, Lab3B, Lab4B, Lab5B
20% – Midterm (as shown in the schedule)
40% – Final Exam (time TBA)

Comments:
Quizzes will be equally weighted. LabB's will be equally weighted. Makeups for the final exam and midterm and only with the appropriate documentation and approvals by UWO's process and will be via ProctorTrack. Makeups for the quizzes will be via ProctorTrack or pro-rated grade.

Note that self-reported absences (SRA) can not be used for the Lab Test scheduled in the last week of classes above. Note also that since Labs extend over 2 weeks, an SRA (applicable to a 48 hour period) can not be used as justication for not doing a Lab. The midterm exam will be partly computer-based and assess proficiency in Matlab and the principles of numerical analysis.

Schedule (tentative)

Week: Dates	Description
1: Jan 11 – 17	Mon Jan 11 [first lecture]. Lab0A [attendance taken, attend your designated lab Tues/Thu]
2: Jan 18 – 24	Lab1A [Quiz1 in Lab]. Tues Jan 19 last day to add a 2nd term course.
3: Jan 25 – 31	Lab1B [Due Sun Jan 31 at 11:59pm]. Sun Jan 31: Deadline for relief against a final grade for 1st term course.
4: Feb 1 – 7	Lab2A [Quiz2 in Lab].
5: Feb 8 – 14	Lab2B [Due Frid Feb 12 at Noon].
Feb 15 – 21	Spring Reading Week
6: Feb 22 – 28	Lab3A [Quiz3 in Lab]. Midterm Sat Feb 27, 7 – 10 PM (to be finalized)
7: Mar 1 – 7	Lab3B [Due Sun Mar 7 at 11:59pm].
8: Mar 8 – 14	Lab4A [Quiz4 in Lab]. Sun Mar 14 Last day to drop a course.
9: Mar 15 – 21	Lab4B [Due Sun Mar 21at 11:59pm].
10: Mar 22 – 28	Lab5B [Quiz5].
11: Mar 29 – Apr 4	Lab5B [Due Sun Apr 4 at 11:59pm]. Friday, April 2, 2021, Easter Friday (Holiday)
12: Apr 5 – 11	
13: Apr 12 – 18	Mon Apr 12 (last lecture), Tues Apr 13 (Study day), Wed Apr 14 – Apr 30 Final Exams

Lab related Instructions

Each part B of a lab will require a full written report explaining 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.

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. 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 via Gradescope's Autograder. Grades will be deducted if the above instructions are not followed.

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

1. Technical Requirements:

Stable internet connection

Laptop or computer with MATLAB installed

Working microphone

Working webcam

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.

2. 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.

3. 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.

Rounding of Marks Statement

Across Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. *Final grades* on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

Proctortrack and Zoom

Tests and examinations in this course will be conducted using the remote proctoring service, Proctortrack and Zoom. Note that Proctortrack and Zoom may not be simultaneously used for the same assessment.
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   https://support.zoom.us/hc/en-us

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 and the zoom link above:

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

When Zoom is used for test/exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded. Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

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.

4. Support Services

The following links provide information about support services at Western University.

Academic Counselling (Science and Basic Medical Sciences)

Appeal Procedures

5. Addendum to all Applied 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.

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