

Western University
Course Outline Applied Mathematics 2814G
Winter 2019-20, Numerical Analysis

Instructor: Greg Reid

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

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Instructor Office Hours: Wed 9:30 - 10:30 am at my office. Also I am usually available just after classes. Please approach me at the end of class (Monday or Friday) and I can meet you or a group in the Atrium of the Physics building. Otherwise for a private appointment send me email.

It is your responsibility to regularly check the course web site for emails, grades, announcements, assignments, important dates etc (at least several times a week). Note however that some announcements will be made only in class. Always include AM 2814 in the subject line of emails.

Lectures: M–W–F (8:30 am – 9:30 am) PAB 148

Labs: Lab 003 Tuesdays: 8:30 am – 9:30 am, NCB 105, Lab 002 Thursdays: 9:30 am – 10:30 am, NCB 105

Required Text: *Numerical Analysis*, by Timothy Sauer: (print book) 3rd ed. ISBN 9780134697338, \$122.95. The e-Text. 3rd ed. ISBN 9780134697369, \$80.45 is also available in the Bookstore.

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.

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 equations (linear, nonlinear and differential) and also 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 find 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 particular in a manner sometimes different to the text.

EVALUATION

Your grade will be the better of:

- I: 35% Labs, 25% Midterm Exam (with computers), 10% Lab Test, 30% Final Exam (without computers);
OR
II: 35% Labs, 14% Lab Test, 51% Final Exam (without computers)

Option II is only available if you show up and take the Midterm Exam or have a valid reason for missing it, as determined by the Faculty of Science Dean's office (see below). 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 justification 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 1: Lab 0 (not marked)	Jan 7 & 9
Week 2: Lab 1A	Due Frid Jan 17 at Noon
Week 3: Lab 1B	Due Sun Jan 26 at 11:59 PM
Week 4: Lab 2A	Due Frid Jan 31 at Noon
Week 5: Lab 2B	Due Sun Feb 9 at 11:59 PM
Week 6: Lab 3A	Due Frid Feb 14 at Noon
Reading Week	Feb. 17 – Feb. 21
Week 7: Midterm Prep Feb 25 & 27	Midterm Frid Feb 28
Last day to drop course	Sat Mar 7
Week 8: Lab 3B	Due Sun Mar 8 at 11:59PM
Week 9: Lab 4A	Due Frid Mar 13 at Noon
Week 10: Lab 4B	Due Sun Mar 22 at 11:59 PM
Week 11: Lab 5B	Due Sun Mar 29 at 11:59 PM
Week 12: Lab Test (in your designated lab time)	Mar 31 & Apr 2
Classes End	Frid April 3

LAB INSTRUCTIONS

Each lab is broken into two parts for a total of 50 marks (8% or your final grade for each lab). Part A is worth 10 marks and part B is worth 40 marks.

Submission Instructions

Part A

No written report is required for this part of the lab. A list of suggested problems, including some from the text, will also be provided for background theory, examples etc.

Any code written along with any figures should be submitted on OWL. Further submission instructions will be given in the tutorials.

Part B IMPORTANT! READ THIS CAREFULLY.

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. You do not need to write anything about what was done in part A of the lab. Because this is an essay course you **will** be graded on code style, writing style, grammar, spelling, etc. Additional problems from the text may also be provided.

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 OWL
- Submit a pdf copy of your write up and code online to gradescope (further submission instructions will be given later).

Grades will be deducted if the above instructions are not followed. If either the copy is not submitted to owl or to gradescope then you will receive a grade of 0. **Further instructions will be covered in the tutorials.**

LATE MARKS

Late marks for part A labs:

- 20% deducted for up to **one** day late
- 40% deducted for up to **two** days late
- 60% deducted for up to **three** days late
- 100% if not submitted within 3 days

Late marks for part B labs:

- 20% deducted for up to **one** day late
- 40% deducted for up to **two** days late
- 60% deducted for up to **three** days late
- 80% deducted for up to **four** days late
- 100% if not submitted within 4 days

Currently-Required Language for Course Outlines

The following is a collection of course-outline excerpts currently (as of September 2019) required by the University and/or recommended by the Faculty of Science.

1. **Responsibility for checking prerequisites:** 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 in the event that you are dropped from a course for failing to have the necessary prerequisites.
2. **Statement on academic offences:** 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: UWO Academic Discipline site
3. **Use of plagiarism-checking software:** 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 <http://www.turnitin.com>

4. **Use of cheating-analysis software:** Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.
5. **Statement on services for students in emotional/mental health distress:** Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

[*] 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 Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations. Also see the link Registrarial Services.

[] Acknowledgment of the Science Student Donation Fund:** This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Counselling site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the Chair of the Department or email the Science Students' Council at ssc@uwo.ca.

[*] If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your faculty Dean's Office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from your faculty Dean's Office immediately. For further information please see: [Link for Medical Appeals](#) Also see the [Link to policy on Accommodation Consideration for Student Absences](#)**

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here: [Online Form for Medical accomodation](#) .