1 INSTRUCTIONAL SUPPORT

1.1 Instructor
Dr. Matt Demers  
MACN 543, Extension 53079  
mdemers@uoguelph.ca

Office Hours:
Wednesdays, 3:30 - 5 pm, THRN 1425 (Group)
Thursdays, 2:30 - 4 pm, THRN 1425 (Group)
Fridays, 11:30 am - 1 pm, MACN 543 (Individual)

1.2 Lab Technician
Not applicable.

1.3 Teaching Assistants
Zainab (Momina) Dar  
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Lucy Tran  
pzarva@uoguelph.ca  
Pavel Zarva
2 LEARNING RESOURCES

2.1 Course Website

Various resources, solutions, announcements and grades will be regularly posted to the Math*2130 Courselink page. It is your responsibility to check the page every day.

2.2 Required Resources

The primary resource for the course will be the notes that we build together over the semester. These, typically in a “fill-in-the-blank style” will be posted on a regular basis to Courselink in PDF format. You may download them to fill them in during lectures using a tablet, or print them off instead.

2.3 Recommended Resources


This textbook will be a significant source of exercises through the semester! It comes highly recommended as I have not had the chance to develop a “For You to Try” section for this course yet. I will post problem sets from this book regularly through the course and it is expected that you will keep up to date with them to stay on top of the material.

2.4 Additional Resources

Lecture Information:

In lectures we will develop the mathematics and logic behind many numerical methods and algorithms that we will use throughout the semester; you will use some of this knowledge to build your MATLAB assignments in lab each week.

Weekly Exercises:

Some extra problems may be posted to Courselink each week or recommended from the textbook. Even though they will not be for grades, these are there for you to practice with, beyond those that we cover in lectures and assignments. To gain proper understanding, I highly recommend that you do not procrastinate; rather, attempt these as they are posted!

Other:

I might post some resources or provide links from time to time if I create something or come across something that I believe might be helpful to you. Anything like this would be posted to the Courselink site, so again, check it every day.
2.4 Communication & Email Policy

Please feel free to ask any questions during or just after lectures. Do not feel intimidated about contributing during class, because active learning is much more effective than just copying down notes! You may also:

- Come to my posted office hours. Don’t ever hesitate to come by, even if you think you are behind in your studying. Getting you caught up is **exactly** what those opportunities are there for!

- Send me an email (mdemers@uoguelph.ca). If you do this, it would be extremely helpful for you to attach a picture of your work, so I can easily see where you might be stuck and be able to help you more quickly.

3 Assessment

3.1 Dates and Distribution

Lab Assignments:
Worth 1.25% apiece up to a maximum of 10%

In your lab each week, you will be tasked with working in a group of up to three to program a (typically simple) numerical algorithm in MATLAB. These are to be submitted through the Courselink Dropbox by the end of the lab. Each person who contributes to the group must include their name and Student ID# in a comment at the top of the file for the TA to grade. There will be no lab assignments in the first week, or the weeks of Test 1 and Test 2, but the TAs will be facilitating a study session during the usual labs, so please attend nevertheless!

Warmup Test:
Monday, January 20 during your usual lecture time
Worth 10% of your grade (or 0% if your Final Exam Grade > your Warmup Grade)

The Warmup Test will measure your readiness for the course! Topics will include very basic logical flow in programming (conditionals and loops); some simple concepts in arithmetic, functions, calculus, and linear algebra; intermediate value theorem, mean value theorem, and Taylor’s Theorem.

Tests:
Friday, February 7 6 - 7:30 pm  Worth 20% of your grade
ROZH 102 and 104
Friday, March 13 6 - 7:30 pm  Worth 20% of your grade
ROZH 102 and 104
Final Exam:
Monday, April 6
2:30 – 4:30 pm
Worth 40% of your grade, plus the remainder of any grades not obtained through Lab Assignments.

Example 1: Suzanne obtains 65% on her Warmup Test but achieves a grade of 77% on her final exam. She earns a grade of 6.5/10 on her Lab Assignments. Thus, the final exam is worth $50 + 3.5 = 53.5\%$ of her final grade.

Example 2: Jelena does not attend any of her labs (not advisable!), and while she earns a 99% on her Warmup test, she gets a 54% on her final exam. Thus, the final exam is worth $40 + 10 = 50\%$ of her final grade.

3.2 Course Grading Policies

Missed Assessments:
If you are unable to attend any tests due to medical, psychological, or compassionate reasons, please email me. See below for details and consult the undergraduate calendar for information on regulations and procedures for Academic Consideration:

https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations:
If you are unable to meet an in-course requirement due to religious obligations, please email me within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade:
You must receive a final grade of 50\% or greater in order to pass this course. In addition, you cannot pass by virtue of the assignments alone. For this course, that means you must pass at least one of the tests or the final exam, or else your final grade will be capped at 48\%.

Missed Tests:
If you miss a test due to acceptable grounds for granting accommodation, the weight of the missed assessment will be added to the final exam. There will be no makeup midterm tests. If you know in advance that you have a conflict for a test, provide me with at least two weeks of notice. I will try to schedule an alternative writing time ahead of the scheduled assessment (but for clarity, I cannot guarantee that such an arrangement will be possible). Only in very exceptional circumstances will I allow for an alternative time that is afterward.
4 **AIMS, OBJECTIVES & GRADUATE ATTRIBUTES**

4.1 **Calendar Description**

4.2 This course provides a theoretical and practical introduction to numerical methods for approximating the solution(s) of linear and nonlinear problems in the applied sciences. The topics covered include: solution of a single nonlinear equation; polynomial interpolation; numerical differentiation and integration; solution of initial value and boundary value problems; and the solution of systems of linear and nonlinear algebraic equations.

**Prerequisite Courses:**
(CIS*1300 or CIS*1500), (1 of IPS*1510, MATH*1090, MATH*1210, MATH*2080)

4.3 **Course Aims**

This course is taught with the goal of putting into practice some of the concepts and intuition that students have developed with so far in other math courses. This means being able to develop computer programs that can run simple mathematical algorithms, and gaining an understanding of how continuous mathematical objects such as derivatives or solutions to differential equations might be approximated using a discrete numerical approach instead - as well as the error involved in doing so.

4.4 **Learning Objectives**

At the successful completion of this course, the student will have demonstrated the ability to:

1. Explain the general concepts of algorithms, limiting behaviour and asymptotic notation.
2. Gain an understanding of how computers handle numerical data, including floating-point operations, rounding, truncation, iteration, and error.
3. Find roots to single nonlinear equations through the use of various numerical algorithms.
4. Calculate a polynomial interpolant or cubic spline given a set of points.
5. Utilize difference approximations for various derivative operators.
6. Numerically approximate the solutions to initial value problems through a series of increasingly sophisticated approaches.
7. Understand the nature of a Boundary Value Problem and an introduction to numerical techniques for their solution.
8. Numerically approximate the results of definite integrals.
9. Create algorithms for solving linear systems of equations.
10. Use Taylor’s Theorem to produce error bounds for numerical techniques.
4.5 Instructor’s Role and Responsibility to Students

As your instructor, I pledge to:

1. Come prepared to each lecture and deliver course material in a professional way that facilitates learning for a variety of students and learning styles.

2. Respond to you. This includes, as time permits, questions during or after lectures, during office hours, or through email. You are more than welcome to contact me at any time through these means if you have questions or concerns about the course or new concepts.

3. Evaluate you fairly, providing prompt feedback on your performance and justification for any grades you are given. I must provide academic consideration, where appropriate, as described in Section 3.

4.6 Students’ Learning Responsibilities

As a member of this class, you are expected to:

1. Take advantage of the learning opportunities provided during lectures and assignments, and through CourseLink.

2. Treat myself and other students with dignity whenever you address them, in-class or online.

3. Genuinely try all homework in a timely manner and make the effort of attempting optional practice questions, especially if you have faced some trouble with math or programming courses in the past.

4. Seek help if you have tried the homework and are still having difficulty with the course content. This means talking to me! Contact me through email or in office hours (not just at the last minute!) and possibly consider other resources as I recommend them to you.

5. Check all of your posted grades with tests that have been returned to you, to verify that the correct mark has been recorded. If not, then for tests, get in touch with me right away in person or through email, and we will figure things out. For lab assignments, contact your TA and they will do the same.

6. Notify me, as described in Section 3, in the case that there are academic conflicts that are known in advance. If illness, work, or extra-curricular activities are causing you to struggle, you are advised to keep me up-to-date on your progress, so that I can be more helpful to you.

4.7 Relationships with other Courses & Labs

(CIS*1300 or CIS*1500) These courses provide some fundamental programming skills that will come in handy in this course.

(IPS*1510, MATH*1090, MATH*1210, MATH*2080) These courses provide some fundamental mathematical background in functions and calculus that will prove useful as background knowledge.
Follow-On Courses
While Math*2130 is not explicitly a prerequisite for any Mathematics courses at the undergraduate level, it provides an essential set of skills that will be extremely useful to anyone studying math or science in senior or graduate-level courses.

5 Teaching and Learning Activities

5.1 Timetable

Lectures:
Mondays and Wednesdays, 5:30 - 6:50 pm in War Memorial Hall (Section 1)
Mondays, Wednesdays and Fridays, 1:30 - 2:20 pm in THRN 1200 (Section 2)

5.2 Lecture Schedule - (Please note that the timing may vary slightly)

<table>
<thead>
<tr>
<th>Week(s)</th>
<th>Topic</th>
<th>Text Chapter</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Basics of Programming and Algorithms</td>
<td>1</td>
<td>LO 1,2,10</td>
</tr>
<tr>
<td>3-4</td>
<td>Equation-Solving and Root-Finding</td>
<td>2</td>
<td>LO 3,10</td>
</tr>
<tr>
<td>5-6</td>
<td>Polynomial Interpolation and Splining</td>
<td>8</td>
<td>LO 4</td>
</tr>
<tr>
<td>7-8</td>
<td>Numerical Differentiation and Solution of IVPs</td>
<td>1,11,12</td>
<td>LO 5,6</td>
</tr>
<tr>
<td>8-9</td>
<td>BVPs and Finite Difference Schemes</td>
<td>-</td>
<td>LO 7</td>
</tr>
<tr>
<td>10</td>
<td>Numerical Integration</td>
<td>11</td>
<td>LO 8,10</td>
</tr>
<tr>
<td>11-12</td>
<td>Algorithms for Solving Linear Systems</td>
<td>3,6</td>
<td>LO 9</td>
</tr>
</tbody>
</table>

5.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-regregchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml
5.4 Other Important Dates

Monday, January 6:  First day of classes
February 17 - 21:  Reading Week (no classes are scheduled)
Tuesday, October 15: Fall Study Break Day (no classes are scheduled)
Friday, April 3:  Last day of classes and last day to drop a course without academic penalty

6  ACADeMIC MiSCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

6.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar: https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at: https://academicintegrity.uoguelph.ca/

7  ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact Student Accessibility Services as soon as possible.
For more information, contact SAS at 519-824-4120 ext. 56208 or email sas@uoguelph.ca or see the website: https://wellness.uoguelph.ca/accessibility/

8 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9 RESOURCES

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: https://www.uoguelph.ca/registrar/calendars