Math*2270 – Applied Differential Equations – Fall 2021

(Revised: September 8, 2021)

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via Courselink and/or class email. This includes on-campus scheduling during the semester, midterms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website and circulated by email. For information on current safety protocols, follow these links:
https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces
Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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1 Instructional Support

1.1 Instructor

Dr. Matt Demers mdemers@uoguelph.ca

Group (Zoom) Office Hours:
Tuesdays and Thursdays 3 – 4 pm

Also feel free to get in touch to make an appointment with me, or chat with me after our Friday labs!

1.2 Teaching Assistants

TAs:

Quade Butler	qbutler@uoguelph.ca
Mayada Elkhalifa	elkhalim@uoguelph.ca
Prabhjot Kaur	pkaur@uoguelph.ca
Saif Matar	smatar@uoguelph.ca
Sonu Sharma	sonu@uoguelph.ca
Brienne Nelson	brienne@uoguelph.ca
Benjamin Snow	bsnow@uoguelph.ca

TA Office Hours: TBA – stay tuned to Courselink

2 LEARNING RESOURCES

2.1 Course Website

Completed course notes, news, announcements, and grades will be regularly posted to the Math*2270 Courselink page.

2.2 Required Resources

Math*2270 - Applied Differential Equations – Course Manual (Available through Courselink)

This is our primary resource for the course. This will be released free of charge, through Courselink, chapter by chapter as we progress through the course.

2.3 Recommended Resources

Not applicable.

2.4 Additional Resources

Lecture Information:

Lectures will be delivered via an asynchronous (previously recorded) format, accessible through Youtube. *Links to these videos will be provided regularly through Courselink, at a recommended pace*; nevertheless, all of the videos will be available through my Youtube channel so you have the ability to study ahead as necessary. It is extremely important that you treat these as though they were everyday lectures. Make a schedule to watch a video several times per week. It is not advisable to procrastinate, and then "binge-watch" a large number of videos at once! Much of the material in this course takes time to learn, digest, and practice.

A live lab will be offered every week on Fridays. This lab is face-to-face, but will also be live-streamed through Zoom; and also recorded and posted to Courselink. Labs will centre on problems related to recently-recommended material from lectures, and designed to lead you into that week's lab assignment.

In summary: Lectures and labs are being designed this semester to cater to as many different preferences and needs as possible, given the uncertain and transitional nature of these times. If you have any suggestions or questions related to delivery and how I can create a better experience for you, please do not hesitate to get in touch.

Past Tests and More:

Assignments and tests from recent offerings of the course will be posted online with full solutions available. This is an opportunity for you to see and work on extra problems that are at the level I expect from you. *This does not in any way, however, imply that the assignments and tests of this semester will be or should be identical to or similar to those of previous years.* I may also post extra 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!

2.5 Communication & Email Policy

Please feel free to ask any questions during or just after the live labs. Do not feel intimidated about contributing during these labs, because active learning is much more effective than just copying down notes! If you can't ask me a question during or after lab, though, there are still options for help:

- One TA, Quade, will be holding regular office hours, available to you on a weekly basis specifically to assist with assignments and test preparation. Get to know him!

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

- Use the discussion forums available to you on Courselink. It is possible that a classmate will know the solution and will be able to help you, and it will be useful to have classmates to collaborate with. Myself and a TA will be monitoring the boards to help answer questions in case a classmate is unable to jump in with a response first. Remember: It is GREAT practice to help and explain one concepts to one another!

- 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. I will always aim to respond within a day, and quicker whenever I can.

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3 ASSESSMENT

3.1 Dates and Distribution

Any missed assessments will have their weight transferred automatically to the final exam. You do not need to provide any documentation; you do not need to contact me.

Warmup:
Due Monday, September 20 at 8:00 pm
Worth 10% of your grade if this grade is higher than your Exam grade, or 0% otherwise.

The Warmup is an extended assignment, available starting September 13, that will cover topics from high school math, first-year calculus and linear algebra that you should already be familiar with. All problems should be straightforward, and will help you to gauge your readiness for the course. More information will be provided on Courselink and in the first lab.

Lab Assignments:
Released every week (generally on Thursday or Friday), due on the next Monday evenings at 8:00 pm. The first will be released the week of September 13-17.
These are worth 20% of your grade, evenly split among your labs.

A short assignment will be made available through Courselink after each lab, generally pertaining to the material from the lectures of the week before. You may work individually or in groups of up to three. If you do work in a group, the names of all members must be clearly present on your submitted work. *Note: NO lab assignment will be given over Thanksgiving Weekend, or during the very last week of class.*

Tests:

Friday, October 15	Friday, November 12
6:00 – 8:00 pm	6:00 – 8:00 pm
Worth 15% of your grade	Worth 25% of your grade

Tests will be virtual, unmonitored, and open-book.

For some parts, you may have the opportunity to collaborate with other students. However, you are responsible for understanding the logic behind any written solutions. If the TAs or myself are unclear about your understanding for a provided solution, based on what you have written down, we reserve the right to contact you through email to schedule a friendly and short (~5 minute) virtual meeting to discuss the test. ***Your grade may go up or down based on this discussion!*** Not replying to this email may result in the loss of marks, so keep your eyes open for it. The use of Chegg or any other quick-help websites is strictly prohibited. Please note that it is much easier to detect a "Chegg answer" than you might think. Be smart about the choices that you make.

If your test solutions are submitted late, a grade penalty will be applied. Past a designated time, the test weight will instead be automatically dropped and added to your final exam weight. Details on this will be provided ahead of each test.

Important: By submitting any solutions (or portion) to any assessment, you are committing to have the assessment graded and for the result to be contributed to your final grade. In other words, you cannot "drop" a test after seeing that you performed below your expectations on the assessment.

Final Exam:
Friday, December 11 at 8:30 am
Worth 30% of your grade, if your Warmup grade is better than your Exam grade; *OR*
Worth 40% of your grade, if your Exam grade is better than your Warmup grade.

The final exam will be cumulative. Be prepared for material from over the entire course.

3.2 Course Grading Policies

Missed Assessments and Tests:
If you know in advance that you will be unable to attend any tests due to medical, psychological, compassionate, or other reasons, please email me. We may be able to come to an agreement to reweight the test to other components of the course, or provide an alternative assessment, depending on your situation. I ask that you provide me with at least two weeks of notice. I will try to schedule an alternative time, as close to the test time as

possible, to write the scheduled assessment (but for clarity, I cannot guarantee that such an arrangement will be possible). 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.

Missed Lab Assignments:
Once the TAs have begun grading labs, new submissions will no longer be accepted. The weight of these labs would then be passed automatically to the final exam.

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g. final exam or major assignment).

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4 Aims, Objectives & Graduate Attributes

4.1 Calendar Description

Solution of differential equations which arise from problems in engineering. Linear equations of first and higher order; systems of linear equations; Laplace transforms; series solutions of second-order equations; Fourier series and introduction to partial differential equations.
Prerequisite(s): One of IPS*1510, MATH*1210, or MATH*2080
Corequisite(s): Engg*2400 (for Engineering Students)

4.2 Course Aims

This course is taught with the view to combine a sound and accurate exposition of the elementary theory of differential equations with considerable emphasis on methods of solution that have proved useful in a wide variety of applications in science and engineering. A primary objective of this course is to motivate the ideas and results of ordinary differential equations for use in modeling of engineering systems. An introduction to partial differential equations is given to prepare the student for study of transport phenomena involving fluid mechanics, heat transfer and mass transfer.

4.3 Learning Objectives

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

1. Discern between partial differential equations (PDEs) and ordinary differential equations (ODEs/DEs); linear and non-linear DEs; homogeneous and nonhomogeneous DEs; first and higher-order DEs; and specific types of first-order DEs.
2. Solve particular types of DEs using a variety of common methods, understanding that a given problem could be solved using many different approaches.
3. Explain qualitative aspects of solutions to ODEs, including equilibrium points and the long-term behaviour of solution curves.
4. Effectively use and deeply understand mathematical tools including Laplace transforms, Taylor series and Fourier series, and how they might be used to solve ODEs or PDEs.
5. Translate word problems in various applications into mathematical language before solving them.

4.4 Graduate Attributes (for Engineering)

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 3, 4, 5	Labs, Tests, Exam
2. Problem Analysis	1, 2, 3, 4, 5	Labs, Tests, Exam
3. Investigation	-	-
4. Design	-	-
5. Use of Engineering Tools	-	-
6. Communication	1, 2, 3, 4, 5	Labs, Tests, Exam
7. Individual and Teamwork	1, 2, 3, 4, 5	Labs
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	-	-
12. Life Long Learning	-	-

4.5 Instructor's Role and Responsibility to Students

As your instructor, I pledge to:

1. 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, labs, and through Courselink.
2. Treat others with dignity whenever you address them. There are a large number of people enrolled in this class from all walks of life and of all skill levels. Your understanding and respect of this diversity is extremely important!
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 courses in the past.
4. Seek help if you have tried the homework and are still having difficulty with the course content. This means using the Courselink forums to get help from your peers, contacting me through email or in office hours (*not* just at the last minute!) and possibly considering 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

MATH*1160/ENGG*1500; MATH*1200+1210 or IPS*1500+1510. These courses provide the fundamental tools required for the new concepts and methods introduced in MATH*2270.

Follow-On Courses
In the Engineering Program: ENGG*2560, ENGG*2660, ENGG*3260, ENGG*3410, ENGG*3430, ENGG*3470, ENGG*3700, and ENGG*4470. MATH*2270 provides a broad mathematical foundation that any later course involving differential equations will require. Additionally, many applications explored in these later courses are first introduced in **MATH*2270.**

In the Mathematics program: MATH*3100, MATH*3510, and MATH*4270. All of these senior courses involve differential equations and squarely depend upon the concepts introduced in Math*2270!

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:
Asynchronous (lectures will be posted as videos online on a regular basis)

Labs:
Fridays, 1:30 – 2:20 pm, through WebEx

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

Lectures 1-2	Introduction to DEs	Section 1	Learning Objectives 1,3	
3-9	Solutions to First-Order DEs		Section 2	LOs 1,2,3
10-12	Applications of First-Order DEs		Section 3	LOs 1,2,3,5
13-14	Introduction to Higher-Order DEs		Section 4	LOs 1,2
15-16	Solution Techniques for Higher-Order DEs		Section 5	LOs 1,2,3
17-20	Solution Methods for Nonhomogeneous DEs		Section 6	LOs 1,2,3
21-22	Vibrations as an Application of 2nd-Order DEs		Section 7	LOs 1,2,3,5
23-28	Laplace Transforms		Section 8	LOs 1,2,4,5
29-31	Power Series Solutions to DEs		Section 9	LOs 1,2,4
32-34	Solving Linear Systems of DEs		Section 10	LOs 1,2,3
35-36	Introduction to Fourier Series		Section 11	LOs 1,2,4

5.3 Design Lab Schedule

Not Applicable.

5.4 Lab Schedule (Again, be warned that the timing or topics may vary slightly)

Lab 0	Greetings + Course Outline	N/A	N/A
Lab 1	Intro to DEs	Section 1	Learning Objectives 1,3
Lab 2	Direction Fields	Section 2	LOs 1,3
Lab 3	Solving Linear, Separable DEs	Section 2	LOs 1,2
Lab 4	Exact DEs, Substitutions (Ungraded)	Section 2	LOs 1,2
Lab 5	Applications of 1st-order DEs	Section 3	LOs 1,2,3,5
Lab 6	2nd-Order Homogeneous DEs	Section 5	LOs 1,2
Lab 7	2nd-Order Nonhomogeneous DEs	Section 6	LOs 1,2
Lab 8	Vibrations	Section 7	LOs 1,2,3,5
Lab 9	Laplace Transforms	Section 8	LOs 1,4
Lab 10	Step Functions	Section 8	LOs 1,2,4,5
Lab 11	Power Series Solutions	Section 9	LOS 1,2,4
Lab 12	**No lab**		

5.5 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-reg-regchg.shtml
Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

5.6 Other Important Dates

Thursday, September 9: Classes commence
Monday, October 11: Thanksgiving Day (no classes scheduled)
Tuesday, October 12: Fall Study Break Day (no classes are scheduled)
Thursday, December 2: Tuesday class schedule is in effect
Friday, December 3: Last day of classes; Monday class schedule is in effect

6 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.
If the laboratory rules are not followed, consequences will include removing student's access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

7 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.

7.1 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/

8 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/

9 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.

10 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

Mental Health Services:

One out of every five students in Canada experiences some sort of mental health issue at some point in their academic career. If you find yourself facing a mental health crisis, or just need to talk to someone, please consider taking advantage of one of the following resources available to University of Guelph students:

Counselling Services: Visit the Counselling Services website (https://wellness.uoguelph.ca/counselling) to get information on resources available to you, both online and in-person. You can also visit them at Health Services (J.T. Powell Building, ext 53244) where they offer individual and group counselling sessions by appointment or walk-in.

Student Support Network: is located in the Wellness & Education Promotion Centre in the J.T. Powell Building and offers confidential, peer-based, drop-in support.

Good2Talk: (1-866-925-5454) is a free, 24/7 student hotline that provides professional

counselling and referrals for mental health, addictions and well-being.

Here 24/7: (1-844-437-3247) specializes in assessment, referral and appointment booking and is available 24/7 for crisis support.

You are not alone and you will not be judged for asking for help.