MATH*3100
Differential Equations II
Winter 2022

(Revision 2: January 19, 2022)

DISCLAIMER:

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email. This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Kimberly M. Levere, Ph.D.
Office: MacN 539, ext. 56908
Email: klevere@uoguelph.ca

Office hours:
Mondays 3:00pm-4:00pm via Zoom (https://zoom.us/j/97306944219)

Due to large class size, office hours are held in a group setting. I have found this to be a very productive and supportive learning environment in the past. Should you require an individual, private appointment with me, please contact me by email to set up a meeting.

1.2 Teaching Assistant (and their Office Hours)

Sarah Smook
Office Hours: Tuesdays 1:00pm-2:00pm via Zoom (https://zoom.us/j/99494838706)

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the MATH*3100 Courselink website. You are responsible for keeping up-to-date on this site.

2.2 Required Resources

The course manual MATH*3100 – *Differential Equations II - Course Manual 4th Edition)*, is available at the MacNaughton Bookstore. This is the primary resource for the course and functions both as the textbook, and as a notebook that we will complete together in class as the course progresses. It can be purchased as a printed copy, or as a pdf. Please be sure that you have the current version, the 4th edition, (only available in the MacNaughton bookstore) as a few changes have been made to last year's manual. Remember that this resource is protected by copyright and is not to be sold or redistributed in any form.

2.3 Recommended Resources

Elementary Differential Equations and Boundary Value Problems by Boyce, DiPrima & Meade. Any edition is fine; the newest is the 12th.

As I teach this course more, I am slowly developing more problems on my own for you to practice with. Perhaps hold off on buying this and see if what I'm providing for practice seems sufficient for you. ☺

Lecture Information:

It is strongly recommended that you attend every class. We will complete the course manual together during lectures so please bring it to every class.

2.4 Communication & Email Policy

Please use office hours and Courselink discussion forums as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

2.5 Getting Help

My number one priority is to ensure that you are supported and have lots of opportunities to ask questions and get help! Here are some options for getting help in this course:

- Come office hours (either mine or the TA's). Don't ever hesitate to drop in, even if you think you are behind in your studying. Getting you caught up is **exactly** what those opportunities are there for!
- Post to the discussion board on Courselink. This is a great place to post your questions! I will check this often and respond as soon as I am able. I have even given you the option

to post anonymously in case you are shy ☺ It is also a great way for you to help others if you see a question that someone else posts that you can help out with! This is one of the best ways to master a concept: by explaining it to someone else!

- Send me an email (klevere@uoguelph.ca). Since there are 80 of you and only ONE of me, I would prefer to answer questions in a group forum (so that I can help more of you at once), but certainly for more personal queries, this is a great option. If you ask questions by email (or even in Courselink!), 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 usually try to respond within a few hours. However, I get a lot of email from students and I need to make sure that I have the chance to help as many people as I can in the time I have! So be warned that if you send me many emails with various questions, it may take a day or two to get back to you.

---

3 ASSESSMENT

3.1 Dates and Distribution

Your grade will be determined using the following grading scheme:

	Scheme #1	Scheme #2	Scheme #3
Academic Misconduct Quiz	1%	1%	1%
In-class Quizzes	15% (5% each)	15% (5% each)	15% (5% each)
Term Test 1	20%	10%	20%
Term Test 2	20%	20%	10%
Final Exam	44%	54%	54%

*You must obtain at least an 80% on the Academic Misconduct Quiz in order for it to be considered complete.

** You must pass at least one of Term Test 1, Term Test 2, or the Final Exam in order to be eligible to pass this course. Failure to do so will result in a final grade that is capped at 48%. Considerations may be made according to the policies listed in Section 3.2.

Schedule of Dates

At the moment, the pandemic has forced us to deliver courses remotely until (at least) January 30th. Depending on public health regulations at that time, we may be forced to complete additional weeks remotely. This wasn't my original plan, obviously, so with great optimism I shall include the locations that were scheduled for your assessments in the table below. Should the pandemic force us to remain remote beyond January 30th, some of these assessments may need to be completed remotely. I will provide regular updates on Courselink as details become available regarding the location of each of the above assessments as the situation unfolds.

Assessment	Date/Time	Content Coverage (subject to change)
Academic Misconduct Quiz (1%)	Opens on Courselink: Monday, January 10, 2022 Due: Friday, January 21, 2022 at 5:00pm	https://www.uoguelph.ca/registrar/calendars/undergraduate/2020-2021/c08/c08-amisconduct.shtml Including all sections listed on this page.
Quiz 1 (5%)	Wednesday, January 26, 2022 Remote, closed book, closed resource. Due to Crowdmark system by 5:20pm	In Chapter 1: weeks 1 & 2 inclusive
Term Test 1 (10%-20%)	Wednesday, February 9, 2022 **4:30pm-5:50pm MCKN*029	All of Chapter 1
Quiz 2 (5%)	Wednesday, March 2, 2022 4:30pm-5:00pm in MCKN*029	In Chapter 2: p. 58-p.106 inclusive
Term Test 2 (10%-20%)	Wednesday, March 16, 2022 **4:30pm-5:50pm MCKN*029	All of Chapter 2
Quiz 3 (5%)	Wednesday, March 30, 2022 4:30pm-5:00pm in MCKN*029	In Chapter 3: up to end of week 10.
Final Exam (44%-54%)	Monday, April 18, 2022 8:30am-10:30am Location: TBA	Cumulative

** Note that your lab time has been extended from 5:20pm to 5:50pm to give you adequate time to complete your term test. If this produces a conflict with your class schedule for another course, please let me know ASAP.

*For online assessments: I reserve the right to institute proctoring software at any time if cases of academic misconduct arise.

3.2 Course Grading Policies

Academic Consideration: When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars. Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtm

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at 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: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Missed term tests or quizzes: Missed term tests or quizzes will receive a grade of 0%, unless you miss an assessment due to any of the above reasons and **bring it to the attention of the course instructor within 1 week of the assessment date in a written email (with appropriate documentation if required)**, in which case the weight of the missed assessment will be added to the final exam. There will be no makeup tests or quizzes.

Illness: 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).

Covid-19 Safety Protocols: For information on current safety protocols, follow these links:

https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-yoursafe-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.

Passing grade: In order to pass the course, you must receive a final grade of at least 50%. Additionally, you must pass at least one of Term Test 1, Term Test 2, or the Final Exam in order to be eligible to pass this course. Failure to do so will result in a final grade that is capped at 48%.

Group Work: You are encouraged to work together to learn the course material and complete For You to Try exercises. All quizzes, term tests and the final exam are individual assessments and must be completed independently.

---

4 Aims, Objectives & Graduate Attributes

4.1 Calendar Description

This course continues the study of differential equations. Power series solutions around regular singular points including Bessel equations are presented. First order linear systems and their general solution by matrix methods are thoroughly covered. Nonlinear systems are introduced along with the concepts of linearization, stability of equilibria, phase plane analysis, Lyapunov's method, periodic solutions and limit cycles. Two-point boundary value problems are discussed and an introduction to linear partial differential equations and their solution by separation of variables and Fourier series is given.

Credit Weight: 0.5 **Department:** Mathematics & Statistics **College:** CEPS **Campus:** Guelph

Prerequisite: (1 of MATH*1160, MATH*2150, MATH*2160), (MATH*2170 or MATH*2270)

4.2 Course Aims

This course utilizes the concepts from your first differential equations course in order to extend these concepts. The main goals of the course are (1) the extension of power series solutions to discuss irregular singular points, (2) the extension of single differential equations to systems of linear differential equations and phase portraits, (3) a study of nonlinear differential equations, linearization, and Lyapunov functions, (4) the possibility of periodic solutions and limit cycles and (5) an introduction to partial differential equations. The objective of the course is to give you a strong background in ordinary differential equations that you will require as you progress through your degree (and beyond), as well as to introduce you to partial differential equations and their role in mathematics.

4.3 Learning Objectives

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

1. Identify ordinary, regular and irregular singular points and find power series solutions where possible.
2. Solve linear homogeneous systems of ODEs, draw their phase portraits, and analyze their stability.
3. Solve linear non-homogeneous systems of ODEs.
4. Solve first-order autonomous nonlinear systems of ODEs via linearization, draw local and global phase portraits and classify local stability.
5. Utilize Lyapunov functions to classify global stability of equilibria.
6. Identify the existence or non-existence of periodic solutions and limit cycles.
7. Solve the heat equation via separation of variables.
8. Present small theoretical proofs regarding existence and uniqueness and other relevant properties.
9. Have a strong understanding not only of HOW to solve a problem, but why the technique works and how it was developed.

4.4 Instructor's Role and Responsibility to Students

As your instructor, I must:

1. Develop and deliver course material in a professional way that facilitates learning for a variety of students and learning styles;
2. Attend all lectures, filling in the course notes as we proceed in each lecture.

3. Respond to you. This includes, as time permits, questions in lectures, after classes, during office hours, or through email (where I reserve the right to reply within a timeframe of 1-2 days). You are more than welcome to contact me at any time through these means if you have questions or concerns about the course or the course material.
4. Evaluate you fairly, and fairly as compared to your peers, providing prompt feedback on your performance and justification for your grade. I must provide academic consideration, where appropriate, as described in Section 3.

4.5 Students' Learning Responsibilities

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

1. Take advantage of the learning opportunities provided during lectures and on assignments;
2. Treat others with respect and dignity whenever you address them, in-class or online.
3. Genuinely attempt assignment questions, and complete an appropriate number of practice problems from the textbook in a timely manner, including assignments, on your own time;
4. Seek help if you have tried the assignment questions and/or textbook exercises and are still having difficulty with the course content. This means contacting me (*not* just at the last minute!) and possibly considering other resources as I recommend them to you;
5. Check all grades against tests that have been returned to you, once they are posted to the Course website, to verify that the correct mark has been recorded.
6. Notify me, as described in Section 3, in the case that there are missed tests or 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.

---

5 Teaching and Learning Activities

5.1 Timetable

Lectures: Monday, Wednesday, Friday 8:30am-9:20am in MCKN*029
Labs: Wednesdays 4:30pm-5:20pm in MCKN*029

**In response to public health measures, the University of Guelph has asked that we deliver the first two weeks of lectures and labs remotely. For the period from January 10 – January 30 inclusive, all lectures will be delivered asynchronously. Lecture recordings may be found on Courselink, organized by week. Labs will run synchronously via Zoom, (https://zoom.us/j/97306944219). In this period it is extremely important that you ask questions and attend office hours to ensure that you are getting the help that you need to learn effectively.

We will return to in-class instruction starting January 31st , 2022, or as soon as it is deemed safe enough to do so by public health and the University.

5.2 Lab Schedule

Weekly lab sessions will give you the opportunity to tackle tougher problems, extra practice questions or even brand new, related concepts. I may also use this time to cover course material directly from the Course Manual. It is your responsibility to obtain completed notes from lab tutorials if you cannot attend as these will not be posted online unless otherwise specified. Material covered is fair game for testing. All of your assessments will also be held during lab times (note that the lab time has been extended to 5:50pm for both of your term tests to allow adequate time for completion. Please let me know ASAP if this causes a conflict with another one of your courses).

5.3 Lecture Schedule

(schedule is approximate and subject to change depending on time constraints)

Lecture Topics	**References**	**Approximate Timing**
Power Series Solutions	Chapter 1	Weeks 1-4
Systems of First-Order Linear ODEs	Chapter 2	Weeks 5-8
Systems of First-Order Autonomous Nonlinear ODEs	Chapter 3	Weeks 9-10
Periodic Solutions and Limit Cycles	Chapter 4	Week 11
Introduction to Partial Differential Equations	Chapter 5	Week 12

5.4 Other Important Dates

First day of classes: Monday, January 10th, 2022.
Reading Week: Monday, February 21st, 2022-Friday, February 25th, 2022. (no classes)
Good Friday: Friday, April 15th, 2022. (no exams)
Last day of classes: Friday, April 8th, 2022.

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

Student Feedback Questionnaires: Near the end of the term, you will be given the opportunity to evaluate your instructor and the course by providing comments regarding your experience.

The questionnaires for this class will be done online. I will inform you of when these are to take place. I appreciate your participation on this ☺

6 ACADEMIC INTEGRITY

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 encourages academic integrity. 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 or faculty advisor.

Undergraduate Calendar - Academic Misconduct
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

7 ACCESSIBILITY

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student. When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway. Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to book their exams at least 14 days in advance and not later than the 40th Class Day. For Guelph students, information can be found on the SAS website https://www.uoguelph.ca/sas

8 RECORDING OF MATERIALS

Presentations which are made in relation of 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.

Posted online videos and course notes are the property of the instructor and are not to be otherwise disseminated beyond this course.

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.
http://www.uoguelph.ca/registrar/calendars/index.cfm?index

10 MENTAL HEALTH RESOURCES

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.