

**MATH\*3100**  
**Differential Equations II**  
**Winter 2023**



(Revision 1: January 9, 2023)

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.

**DISCLAIMER:**

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, classroom schedules, 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.

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## 1 INSTRUCTIONAL SUPPORT

### 1.1 Instructor

**Kimberly M. Levere, Ph.D.**

Office: MacN 539, ext. 56908

Email: [klevere@uoguelph.ca](mailto:klevere@uoguelph.ca)

Office hours: Tuesdays 11:30am-12:30pm MACN\*539 (Kim)

Wednesday 10:00am-11:00am MACN\*539 (Kim)

Fridays 2:00pm – 3:00pm MACN\*434 (Maria)

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

Maria Gheta

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## 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 5th 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 5<sup>th</sup> 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.

#### 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.

### 2.3 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.

### 2.4 Online Behaviour and Etiquette

#### Online Behaviour:

Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Disrupting a class/office hour by discussing entirely unrelated content to that of MATH\*3100.
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments

- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Making false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your username and password
- Recording lectures without the permission of the instructor

Any student that does not conduct themselves in an appropriate manner in any online lecture or office hour session will be issued a penalty of a 0.5% deduction on their final grade. This will apply each time inappropriate online conduct occurs. Please be kind to each other and conduct yourself with maturity and professionalism.

### **Disclaimer: Student Identity Disclosure in Recordings**

The university has requested that I include the following disclaimer regarding recorded materials. While I don't anticipate the use of any videos or recordings as our class will be run entirely face-to-face, I want to ensure that we are prepared in the case that the pandemic pushes us in this direction.

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote.

If a student prefers not to be distinguishable during a recording, they may:

1. turn off their camera
2. mute their microphone
3. edit their name (e.g., initials only) upon entry to each session
4. use the chat function to pose questions.

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

## **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](mailto:klevere@uoguelph.ca)). Since there are 40 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.

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## 3 ASSESSMENT

### 3.1 Dates and Distribution

Your grade will be determined using the following grading scheme:

	Scheme #1	Scheme #2	Scheme #3
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	45%	55%	55%

Your final grade will be calculated using the most favourable of the above grading schemes.

**\*\*You must receive at least 50% of the marks available, in total, on the term tests and final exam that are used to calculate your final grade. That is,**

$(\text{Total marks earned on term tests and exam}) \div (\text{Total marks available on term tests and exam}) \geq 50\%$

If you do not achieve this, your maximum possible final grade will be 48%, *no matter what grade you receive on the Quiz component*. Provided that you satisfy the above equation, your final grade will be calculated using the above listed grading scheme.

Considerations may be made according to the policies listed in Section 3.2.

For example: suppose that Kevin receives 20/30 on TT1, 5/25 on TT2 and 26/45 on the final. The above calculation for Kevin would be:

$$(20+5+26) \div (30+25+45)=0.51$$

Since this is greater than 0.50, Kevin is eligible to pass, and his grade will be calculated according to the weighted grading schemes listed above (including his quiz marks).

On the other hand, suppose that Luke receives 18/30 on TT1, 7/25 on TT2 and 20/45 on the final. Then for Luke:

$$(18+7+20) \div (30+25+45)=0.45$$

Since this is less than 0.5, Luke would be awarded a maximum grade of 48% (his grade would be calculated according to the weighted grading schemes above but would then be capped at 48%).

### Schedule of

### Dates

Assessment	Date/Time
Quiz 1 (5%) (Week 3)	Monday, January 23, 2023 In your scheduled lab 2:30pm – 2:55pm in MCKN*121
Term Test 1 (10% or 20%) (Week 5)	Tuesday, February 7, 2023 5:30pm-7:00pm TBA
Quiz 2 (5%) (Week 7)	Monday, February 27, 2023 In your scheduled lab 2:30pm – 2:55pm in MCKN*121
Term Test 2 (10% or 20%) (Week 9)	Tuesday, March 14, 2023 5:30pm-7 :00pm TBA
Quiz 3 (5%) (Week 11)	Monday, March 27, 2023 In your scheduled lab 2:30pm – 2:55pm in MCKN*121
Final Exam (45% or 55%)	Monday, April 24, 2023 7:00pm-9:00pm Location: TBA

### 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 in writing, with your name, ID number, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**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).

**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 quizzes and tests 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**, in which case the weight of the missed assessment will be added to the final exam. There will be no makeup tests or quizzes.

**Regrades:** Students should always review the solutions and grading guidelines for an assessment prior to requesting a regrade. If you feel that you have been unfairly or incorrectly graded on an assessment, please email me with the specific question(s) and why. This must be done within 1 week of when the assessment is returned to you. I put this timeline on regrades as I have a duty to treat all students equally and outside of a week, I can't ensure that I will fully remember the grading scheme or how I handled particular errors.

**Passing grade:** In order to pass the course, you must receive a final grade of at least 50%. Additionally, in order to pass this course, you must receive at least 50% of the marks available collectively, on the term tests and final exam that are used to calculate your final grade. If you do not achieve this, your maximum possible final grade will be 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.

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## 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 the for you to try exercises;
2. Treat others with respect and dignity whenever you address them, in-class or online.
3. Genuinely attempt an appropriate number of practice problems from the textbook in a timely manner, on your own time;
4. Seek help if you have tried the for you to try 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 assessments 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.



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## 5 TEACHING AND LEARNING ACTIVITIES

### 5.1 Timetable

**Lectures:** Monday, Wednesday, Friday 11:30am-12:20pm in MCKN\*121

**Labs:** Mondays 2:30pm-3:20pm in MCKN\*121

### 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. Quizzes will also be held during lab time.

### 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 9<sup>th</sup>, 2023.

**Reading Week:** Monday, February 20<sup>th</sup>, 2023-Friday, February 24<sup>th</sup>, 2023. (no classes)

**Good Friday:** Friday, April 7<sup>th</sup>, 2023. (no classes)

**Last day of classes:** Monday, April 10<sup>th</sup>, 2023 (runs as a Friday schedule in lieu of Good Friday)

**Drop Date:** Courses that are one semester long must be dropped by the end of the last day of classes (**Monday, April 10<sup>th</sup>, 2023**); two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

**Course Evaluation Information:** Near the end of the term, you will be given the opportunity to evaluate your instructor and provide comments regarding your experience. The evaluations for this class will be done in-class. Your instructor will inform you of when these are to take place.

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## 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 assessments 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.

### 6.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://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:

<http://www.academicintegrity.uoguelph.ca/>

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## 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 no later than March 1**. Similarly, new or changed accommodations for online quizzes, tests, and exams must be approved at least a week ahead of time.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

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## 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.

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## 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>

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## 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](tel: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](tel: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.