

# MATH\*3100: Differential Equations II

## Winter 2024

### Instructor

Name	Office	Office Hours	Email
██████████	██████████	██████████	██████████

### Teaching Assistant

Name	Office	Office Hours	Email
██████████	██████████	██████████	██████████

### Course Description

Credit Weight: 0.5 This weighting should be reflected in your efforts and apportioned study time.

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.

Prerequisites: MATH\*2270, (1 of ENGG\*1500, MATH\*1160, MATH\*2150, MATH\*2160)

### Course 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.

## Meeting Times

### Lectures

Day	Time	Location

### Labs

Day	Time	Location

## Course Materials

### Required

- Elementary Differential Equations & Boundary Value Problems (Boyce, DiPrima, Meade; 12<sup>th</sup> Ed.)
- Blank lecture slides from CourseLink

## Evaluation

Assessment	Scheme 1	Scheme 2
Lab Quizzes (3) <sup>†</sup>	15%	15%
Tests (2)	40%*	30%**
Final Exam	45%	55%
Total	100%	100%

<sup>†</sup>Lab Quizzes are equally weighted

\*Tests are worth 20% each in Scheme 1

\*\*Worse test is worth 10%, better test is worth 20% in Scheme 2

**Your mark will be calculated using the more beneficial of the two schemes**

## Course Elements

### Labs

The TA will either cover additional topics, go over practice problems, or invigilate a quiz to be completed during the lab period. Material covered in the labs is fair game for the tests and final exam.

Labs will begin in week 2

## Homework

The instructor will periodically assign practice problems from the textbook that are not to be handed in. Solutions for some of these will be posted to CourseLink, while the TA will go over solutions of others during some lab sessions.

## Tests

Details on the number of questions, format, and scope of content for each test will be provided by the instructor in advance of the scheduled dates.

[REDACTED]

[REDACTED]

## Final Examination

The final examination will be held on [REDACTED]. Details about the content and location will be discussed during the semester. The exam will cover the entire course.

## Grades, Regrades, and Missed Assessments

Graded assessments will be scanned and graded digitally on Gradescope. Gradescope access will be granted to you after the first quiz has been scanned and uploaded. Regrade requests for each assessment will be open for 1 week after grades have been released. You will have the ability to point out specific parts of specific questions for which you feel you were unfairly or incorrectly graded. After the 1-week period for a particular assessment has passed, no further regrade requests for that assessment will be considered. Any missed assessment will have its weight transferred to the final exam.

## Lecture schedule (approximate)

Weeks	Topics	Textbook
1-4	Power-Series Solutions	Chapter 5
5-8	Systems of First-Order Linear ODEs	Chapter 7
9-10	Systems of First-Order Autonomous Nonlinear ODEs	Chapters 7, 9
11	Periodic Solutions and Limit Cycles	Chapter 9
12	Introduction to Partial Differential Equations	Chapter 10

**Note:** The first day of classes is Monday, Jan. 8. Winter break starts on Monday, Feb. 19, and classes resume on Monday, Feb. 26. No classes will be held on Friday, Mar. 29. To compensate for this, Monday, Apr. 8, will be treated as a Friday.

## Course Statements

### Collaboration versus Copying

Scientists work alone or in groups, very often consulting fellow scientists and discussing their research problems with peers. Collaboration is a feature of scientific activity and there are many benefits to working with others. However, no ethical scientist would ever publish or claim the work of others as his or her own and generally scientists give reference to the appropriate source of ideas or techniques which are not their own.

## University Statements

### Email Communication

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.

### When You Cannot Meet a Course Requirement

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. See the Undergraduate Calendar for information on regulations and procedures for [Academic Consideration](#).

### Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; 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.

### Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). 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)

### 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 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.

The [Academic Misconduct Policy](#) is outlined in the Undergraduate Calendar.

### 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, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### 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.

### 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.

### 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).