

Course Outline: Fall 2022
Applied Mathematics 2402a - Ordinary Differential Equations

Instructor: Prof. Lindi Wahl, lwahl@uwo.ca, MC 267,
Office hours: In person and online, dates and times TBD after discussion with class
TA: TBD

Lectures: M/W/F 2:30 – 3:30pm, NCB-114

Summary: An introduction to first order differential equations, linear second and higher order differential equations with applications, complex numbers including Euler's formula, series solutions, Bessel and Legendre equations, existence and uniqueness, introduction to systems of linear differential equations. 3 lecture hours, 1 laboratory hour, 0.5 course.

Prerequisite(s): A minimum mark of 60% in Calculus 1301A/B, or a minimum mark of 55% in Calculus 1501A/B or Applied Math 1413, or special permission.

Pre- or Corequisite: Math 1600A/B. (A corequisite means you can take the two courses simultaneously.)

Tutorials: Everyone in the class has one assigned tutorial hour; please consult your timetable. **Tutorials will run on certain weeks only; they will be announced on OWL.** These tutorials are held in computer labs, in case you need help doing the computational components of the course. **Attendance at tutorials is not required.** You are welcome to attend a tutorial that is not your assigned tutorial if you arrive a few minutes late and seats are still available.

Textbook: *Elementary Differential Equations with Boundary Value Problems*, by William Trench (2013) is required. This is a free online textbook; a copy is available on OWL. The Student Solutions Manual for this text is also freely available. This is the second time we are using this free textbook in the course and feedback on the textbook would be welcome!

Evaluation: Assignments (weekly, best 8 out of 9)	20%
Midterm Examination	35%
Monday Oct 24, 7:00pm – 9:00pm (tentative date)	
Make-up Midterm	
Fri Oct 28, 3:30–5:30pm (a different exam with different questions)	
Final Examination (3 hours, December exam period)	45%

Note: a minimum grade of 50% on the examination components is required to pass the course. This will be calculated as: $100 \times (0.35 \times \text{midterm} + 0.45 \times \text{final exam grade}) / 0.8$. Students who do not achieve 50% in this calculation will receive a grade of 45% in the course.

The most important paragraph: The material in this course is really fun and challenging, but it builds very quickly. It is not possible to pass this course by cramming. Practice problems will be assigned for every lecture, and it is recommended that you book fixed times in your weekly schedule to do them.

Taking notes: If you miss a lecture, please get the notes from a friend or colleague in the class.

Working together: Working in pairs or groups, talking about problem solving strategies and studying together is encouraged. The purpose of the assignments in AM2402a is **not to assess (grade) you**; *the purpose of the assignments is to give you extra incentive to keep up with the course work*. You are encouraged to discuss the assignments with others. However, after discussing how to solve the problem, **each student individually must write up their final solution**. That is, go away without any notes from your discussion, and make sure you can produce a solution independently. Even though your final solution was written independently, please write "Worked with Jane Doe" on the top of your assignment, so that the TA will understand if two people seem to use the same highly unusual approach. If the TA judges two or more assignments to be too similar to one another, students involved will lose 1/4 of the assignment component of the course (i.e. 5% of the final course grade). In general, "too similar" means assignments that appear to be copied one from another, rather than the result of discussing a question.

Assignment logistics: Assignments will be posted to Gradescope weekly, on Sunday at the latest, and will be due one week later, on Sundays at 11:55pm. The late penalty is -10%/day, for up to 3 days. The Gradescope link is available on the OWL course site. Assignments must be scanned using a pdf-scanning app before uploading, and pdf pages must be "assigned" in Gradescope for each question of the assignment.

The first assignment will be due on **Sunday September 25**. The lowest assignment grade for each student will be dropped. There are no make-up assignments or extra work to make up for missed assignments.

Software: Some assignment questions will involve computation. Software packages and help in using these packages will be available in the tutorial sessions. However the use of particular software packages on the assignments will **not** be required; **you can use any computer program you like** to complete these assignments.

Hardware: A non-programmable, non-networked scientific calculator may be allowed on the midterm and/or final; if so, this will be announced on OWL ahead of these exams. Proctors for exams do not lend calculators. It is your responsibility to bring the correct calculator and to ensure that it is in proper working order. It's not a bad idea to bring a spare calculator of the same model! Aside from the specified calculator, no other electronic devices (phones, iPods, etc.) may be in your possession during exams, even for timekeeping purposes.

Extra help: There will be many hours each week during which you can obtain one-on-one extra help on course material. These include the tutorials, the TA office hours and the instructor office hours. A document listing all times and locations for one-on-one extra help will be available under "Resources" on OWL. You may also e-mail the TA to arrange a meeting if you have course conflicts during TA office hours. Private tutors are also available; search for the "Tutor Referral Service" or "Private Tutor List" at Western, or talk to the instructor or the TA.

Examinations: A detailed list of chapters and sections which will be covered on the midterm will be posted to OWL. All material covered up to the end of the course will be considered testable on the final exam. The exams will weight each topic in the course approximately as weighted in the lectures. The practice problems assigned at each lecture are the best guide to material that is testable. These questions change from one year to the next, and are not available in advance. However before the midterm and final, a comprehensive list of assigned practice problems will be posted on OWL. Copies of previous exams, both with and without solutions, will also be posted on OWL for study purposes.

Communication: When communicating with you, will use the lectures, the tutorials, and the course website on OWL. In particular, OWL will be used to post assignments, grades, course material (under "Resources") and important announcements. Please also check your official UWO e-mail for announcements regarding this course. For communicating with us, please see the table below.

How to reach us when you need more information

The course welcome page on OWL will list up-to-date TA and instructor contact info, office hours, office room numbers etc.

Type of question/issue	Examples	What to do	Extra tips
questions about course material	<ul style="list-style-type: none"> - I need help with Q1.1 - the solution to Q4.3 is wrong in the manual - I'm lost and need help with Chap. 8! - is method A the same as method B I learned in another course? 	<ul style="list-style-type: none"> - come to office hours and talk to me! - talk in person with the TA at the tutorial - e-mail the TA if it is a quick question 	<ul style="list-style-type: none"> - please don't ask a complicated math question by e-mail (be kind to your TA!)
questions about assignments	<ul style="list-style-type: none"> - is there a typo in Q2 of the assignment? - my grade on OWL isn't the same as my grade on paper - can I use this other method I know to do the assignment? - it's Friday at 3:40 and I forgot to hand in my assignment at the start of class 	<ul style="list-style-type: none"> - e-mail the TA or speak to them in person - ask it during class if it's a question other students may be asking - catch me after class if it's a quick question 	<ul style="list-style-type: none"> - please try not to ask questions about policies that are covered in this outline
personal, administrative issues	<ul style="list-style-type: none"> - I have a disability - I need special permission to be signed into the course 	<ul style="list-style-type: none"> - come speak to me in person, probably during office hours 	<ul style="list-style-type: none"> - don't panic!

	- I have been granted permission by the Dean to miss the midterm - I am a Mustang athlete and need accommodation for tournaments	- you can e-mail me or catch me after class if this is a personal issue but it requires only a quick answer	
requests for grade increases, "extra work", or re-weightings	- I would like my assignments to be worth 40% of the course grade because I didn't do well on the midterm.	- to be fair to all students in the course, requests for personal re-weightings will not be considered	... you might want to make use of study support resources on campus (see "Support Services" paragraph)
questions about which software to use	- can I do the assignments using Excel?	- yes, you can use any software that you like	

Learning Outcomes

After successfully completing this course, you will be able to:

- Recognize and classify differential equations (DEs).
- Verify solutions to ordinary DEs.
- Explain the terms in a DE model of a physical process.
- Describe the meaning of equilibria and stability for DEs and systems of DEs.
- Describe the meaning of eigenvalues and eigenvectors for a system of linear DEs.
- Recognize the appropriate direction field for a first-order DE or DE system.
- Apply appropriate analysis techniques to solve first-order DEs, second-order linear DEs with constant coefficients, systems of first-order linear DEs with constant coefficients.
- Apply and solve higher order DEs using the following methods: variation of parameters, undetermined coefficients.
- Recognize the appropriate phase-plane diagram, illustrating nullclines and equilibria for nonlinear DE systems.
- Construct series solutions to a DE.
- Analyze DEs and DE systems for equilibria and stability.
- Demonstrate an understanding of Newton's Method for numerical solutions of DEs, and prove convergence of Newton's Method to the exact solution.
- Identify the appropriate mathematical technique to apply to a given initial value problem, use this technique to obtain a solution, and interpret the physical meaning of the results.
- Given a description of a physical process in the form of a word problem, identify appropriate DE models of the process.
- Evaluate the validity of model assumptions in a DE model of a physical system.
- Identify the long-term predictions of such a model based on the use of the analytical techniques described above.

Faculty of Science and Western Policies

Prerequisites

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either

synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

OWL

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assignments:

The assignment grade will be calculated as the best 8 out of 9 assignments, and late assignments will be automatically accepted up to 3 days late with a 10% per day penalty. Requests for further accommodation can be made to the instructor by e-mail or during office hours. When accommodation is granted, missed assignments will be re-weighted to the final examination.

Midterm Examination:

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

When accommodation is granted, a make-up examination will be offered.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

Note: missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), which provides

recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf,

Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

In the event of a health lock-down, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remoteproctoring.uwo.ca>.

Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.