Applied Math 2402A Course Outline

1. Course Information

Course Information
Applied Math 2402A, Ordinary Differential Equations.
Lectures: 3 hours per week
Tutorials: 1 hour per week

List of Prerequisites
Prerequisites: a minimum mark of 60% in Calculus 1301A/B, or a minimum mark of 55% in Calculus 1501A/B or Numerical and Mathematical Methods 1414A/B or the former Applied Mathematics 1414A/B or the former Applied Mathematics 1413. Integrated Science 1001X with a minimum mark of 60% can be used in place of Calculus 1301A/B.
Pre-or Corequisite: Mathematics 1600A/B or Mathematics 1700A/B. (A corequisite means you can take the two courses simultaneously.)

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) 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.

2. Instructor Information

Instructor	Email	Office	Phone	Office Hours
Dr. Lindi Wahl	lwahl@uwo.ca		x88795	TBD after consultation with the class.
TAs: TBD				

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.
A mix of online and in-person OH will be offered by the professor and the TA team.

3. Course Syllabus, Schedule, Delivery Mode

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 credit.

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.

Lectures: 3 hours per week
Tutorials: Everyone is the class has one assigned tutorial hour; please consult your timetable. These tutorials are held in computer labs in order to help with and demonstrate the computational components of the course. Attendance at tutorials is not required, however a short (optional) quiz will be offered during the last 10 minutes of the tutorial session each week. You are only allowed to write quizzes in your assigned section, unless you receive permission from the TA to write with the other lab section.

4. Course Materials

All course material will be posted to OWL: https://westernu.brightspace.com/

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 and is posted on OWL.

Students are responsible for checking the course OWL site (https://westernu.brightspace.com/) regularly 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 Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements
Software: Some practice problems will involve computation, and access to a laptop will be required. Software packages and help in using these packages will be available in the tutorial sessions. However the use of particular software packages will not be required; you can use many different languages (eg. matlab, R, python) to complete these practice problems. AI may not be used for any work in this course. The use of online 'homework' services such as Chegg is strictly prohibited.

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 (eg. phones) may be in your possession during exams, even for timekeeping purposes. If you have a phone in your pocket during an examination it will be confiscated.

5. Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below:

Quizzes (optional (see below), weekly, best 8 of 10 per term)   2% each for up to 20%
Midterm Test   35%
     Monday Oct 21, time and room TBD
Make-up Midterm (a different exam with different questions, documentation required)
     Friday Oct 25, time and room TBD
Final Exam   45%

Notes:
(1) All quizzes are optional and can only improve your grade. Any quiz that a student writes has a weight of 2%, for a maximum of 20% of the final grade. For any quiz that a student chooses not to write, if the quiz is offered before the midterm, the weight of that quiz will be added to the midterm test weight. In addition, if a student achieves a higher percentage grade on the midterm test than on any of the quizzes that were offered prior to the midterm, the grade on the midterm will be counted as their grade on that quiz. Similarly, for quizzes offered between the midterm test and final exam, the weight will be rolled to the final exam if a quiz is not written, and the final exam grade will override any lower quiz grades obtained between the midterm and final. Overall, this means that attempting a quiz cannot hurt your final course grade, which can only be improved by the optional quizzes that you choose to write. In the event that a student writes more than 8 quizzes which all have higher grades that the midterm or final as appropriate, the best 8 out of 10 quizzes will be calculated to obtain the quiz portion of the final grade. Quizzes will be offered during the final 10 minutes of each tutorial session. The first quiz will be offered on Thurs/Fri September 12/13, covering material from the first three lectures of the course.

(2) Supporting documentation will be required in order to receive academic consideration to write the make-up midterm test.

(3) A minimum grade of 50% on the examination components is required to pass the course. This will be calculated as: 100*(0.35*midterm + 0.45*final exam grade)/0.8.
Students who do not achieve 50% in this calculation will receive 45% in the course.

(4) Regrade requests for any work in this course must be submitted within ten days of the grade being released to the student.

General information about missed coursework
Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make <u>one</u> Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Midterm Test (Designated by the instructor as the <u>one</u> assessment that always requires documentation when requesting Academic Consideration)

When a student *mistakenly* submits their <u>one</u> allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, <u>the request cannot be recalled and reapplied</u>. This privilege is forfeited.

Evaluation Scheme for Missed Assessments
All quizzes are optional as described above. If a student chooses to write all the quizzes, the best 8 out of 10 will be counted. There are therefore no make-up quizzes or extra work to make up for quizzes that are missed.

A make-up midterm test will be offered as described above for students who obtain Academic Consideration for this assessment.

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

Essential Learning Requirements
Even when Academic Considerations are granted for missed coursework, the following condition is deemed essential to earn a passing grade.
A minimum grade of 50% on the examination components is required to pass the course. This will be calculated as: $100*(0.35*midterm + 0.45*final\ exam\ grade)/0.8$.
Students who do not achieve 50% in this calculation will receive 45% as a final course grade.

Coursework with Assessment Flexibility
By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:
  Quizzes. This course has 10 optional quizzes, and if you choose to write 9 or 10 of them, the 8 quizzes with the highest marks are counted towards your final grade. Should extenuating circumstances arise, students do not need to request Academic Consideration for any missed quizzes, since they are optional.

6. Additional Statements

Religious Accommodation
When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

https://www.edi.uwo.ca.

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, 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 Registrar Services is https://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 their official university address is attended to in a timely manner.

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 the student's responsibility to bring a simple calculator and to ensure that it is in proper working order. Aside from the specified calculator, no other electronic devices (eg. phones) may be in your possession during exams, even for timekeeping purposes. If you have a phone in your pocket during an examination it will be confiscated.

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:

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

Please note that handing in a partially completed quiz cannot hurt your course grade. However handing in a quiz that is judged to be 'too similar' to another student's quiz, or to a solution available through an online service, will result in a penalty. The penalties for scholastic offences are not decided by the course instructor, but in the past scholastic offenses for a single quiz or assignment in this course have resulted in a loss of 5-10% of the final course grade.

In the even that social gatherings are limited (eg. pandemic lockdown), 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 Advising 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/.

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

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

> https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

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

> http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (https://learning.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.

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