Western Science

Department of Mathematics

Applied Math 4216F Course Outline

1. Course Information

Course Information
Applied Math 4216F, Disease Modelling.
Fall 2026

Antirequisite(s): Applied Mathematics 3615A/B, if taken in the 2020-21 or 2021-22, and Mathematics 4958B, if taken in 2022-23 with the topic "Covid Modelling".
Prerequisite(s): Applied Mathematics 2402A/B or Statistical Sciences 2503A/B or Numerical and Mathematical Methods 2270A/B. Recommended: Applied Mathematics 3615A/B and Applied Mathematics 2814A/B as pre- or co-requisites.

Unless students have either the prerequisites for this course or written special permission from the Department of Mathematics to enroll in it, they may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on their academic record. This decision may not be appealed.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Lindi Wahl	lwahl@uwo.ca			

Students must use their Western (@uwo.ca) email addresses when contacting their instructor.

A mix of online and in-person OH will be offered by the professor.

3. Course Syllabus, Schedule, Delivery Mode

The course will provide an overview of the mathematical modelling of the spread of infectious disease within populations and equip students to use mathematical models to describe real-world disease incidence data. Topics include: ordinary differential equation models of endemic, epidemic and pandemic diseases; model selection, data fitting and parameter estimation. 3 lecture hours, 0.5 credit.

Lectures:

Dates	Tues (2 hours)	Thurs (1 hour)	Assessments/Homework
Sept 10		Welcome and introduction, course outline	Input to OWL forum on course design, read 2 active learning papers
Sept 15, 17	Finalize course design, practice using WALS tech; Active learning discussion	Review: systems of ODES.	Matlab "getting started" exercises.
Sept 22, 24	Lecture on basic SIR modelling, equilibria. Matlab tutorial: integrating and plotting ODES.	Active learning: plotting ODEs and longterm behaviour of solutions.	Numerically integrate a system of ODEs, upload to OWL. You can use excel, maple, python, etc. Extra help will be available, showing how to do it with matlab.
Sept 29, Oct 1	Stability: active learning and lecture material.	Lecture and active learning on R0.	**Assignment 1 due** (ODEs, equilibria, 9%) Input to forum on COVID models in the literature and news (next 3 weeks)
Oct 6, 8	Models and data: active learning.	Lecture on parameter reduction	Assignment 2 open (stability, R0, 9%)
Fall Break			
Oct 20, 22	Parameter fitting: active learning.	Lecture/active learning indentifiability and over-fitting	**Assignment 2 due**, Ass't 3 open (comparing models to data, 9%)
Oct 27, 29	COVID models: literature search and compare. How to judge quality of a research paper.	COVID models: non-autonomous ODEs	**Ass't 3 due,** Assignment 4 open (parameter fitting, individual, 9%)
Nov 3, 5	Active learning: Sensitivity analysis lab.	Midterm review and problem-solving session	Prepare for midterm exam, Tues Nov 10 (20%)
Nov 10, 12	**Midterm exam**	COVID modelling: group workshop, datathon details.	Take a break! :)
Nov 17, 19	Active learning: TBD	Guest speaker: COVID-19 task force project	Working on group project: preparing for COVID datathon
Nov 24, 26	COVID **datathon**: testing your model!	Active learning: how to give an awesome project presentation	**Assignment 4 due**
Dec 1, 3	Active learning: scientific writing.	Guest speaker: former AM3615 student now working in public health/modelling	Working on group project: presentation and write-up
Dec 8	**Project presentations**		Project presentations (10%)
Dec 9			**Project write-up**, Wed Dec 9 (20%)

Learning Outcomes

What will I be able to do after taking this course?

1. You will be able to interpret and critically evaluate mathematical models of infectious disease spread. In particular, you will be able to explain each term in the system of ordinary differential equations that comprises a model, articulate the assumptions underlying each term, and assess the validity of those assumptions.

2. You will be able to explain the meaning and importance of the fundamental parameter R_0, and you will be able to determine mathematical expressions for R_0 from simple compartmental models of disease spread.

3. You will have the mathematical tools and modelling experience to create a new mathematical model for a novel infectious disease.

4. You will be able to use a mathematical model, in particular one of your own design, to make predictions about the spread and impact of an epidemic or pandemic.

5. You will be able to critically compare the predictions of a mathematical model to data from public health agencies. You will understand techniques for assessing which model best fits the data and standard methods for quantifying the degree to which a model is or is not in agreement with the data.

6. You will be able to fit a mathematical model to data in order to obtain quantitative estimates of unknown parameters, such as R_0, from disease incidence data.

4. Course Materials

Costs of Textbooks and Other Learning Materials/Activities
There is no required textbook for this course. All course materials will be posted to OWL Brightspace at no cost to students.

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

Students are responsible for checking the course OWL Brightspace site 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 Brightspace 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 assignments will involve computation, and access to a laptop will be required. Software packages and help in using these packages will be discussed in class. However the use of particular software packages will not be required; you can use many different languages (eg. matlab, R, python) to complete these assessments. 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; if so, this will be announced on OWL ahead of this test. Proctors for tests 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 the midterm test, even for timekeeping purposes. If you have a phone in your pocket during a test it will be confiscated.

5. Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below:

Assignments	36%	(4 @ 9%, pdf uploaded to OWL/Gradescope, see dates above)
Midterm Test	20%	(2 hours in class, closed book with 1 cheat sheet, November 10)
Datathon	5%	(modelling and group summary, November 24)
Project presentation	10%	(25 minute group presentation, Dec 8)
Research project write-up	20%	(individual write-up of project, December 9)
Engagement	9%	

Engagement will include: regular contributions to active learning activities in class, articulating your perspective in group discussions, contributions on the OWL forum, contributions to the group project as assessed anonymously by your peers, and other components as communicated through the term.
In order to receive a grade higher than 45% in the course, students must achieve a grade of at least 50% in the research project write-up.
All assignments are due on Fridays 11:55 pm EST unless otherwise specified, with a two-day no-late-penalty period until Sunday 11:55pm. For Assignments 1-3, students will work in randomly assigned groups of 2-3. Assignment 4 will be completed individually.
The research project write-up will also have a 48-hour no-late-penalty period until Friday Dec 11.
Written assignments will be submitted to Turnitin (statement in policies below).
When rubrics are used to evaluate written assessments, they will be posted along with the assignment.
Regrade requests for any work in this course must be submitted within 10 days of the grade being released to the student.

Essential Learning Requirements
Even when Academic Consideration is granted for missed coursework, the following condition is deemed essential to earn a passing grade.
A minimum grade of 50% on the research project write-up is required to pass the course.
Students who do not achieve 50% on this component will receive a maximum of 45% as a final course grade. When a student has not demonstrated proficiency in an essential learning requirement listed above, and when the shortfall results from a granted Academic Consideration, they will be withdrawn (WDN) from the course. The student may appeal to the Associate Dean (Academic) for reinstatement with an Incomplete (INC) standing. Where an appeal for INC is granted, their maximum course load may be reduced during the term in which they complete the outstanding course requirements.

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://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.

Midterms and Tests
This course has one midterm test and no final exam. Because there is no final exam to which the weight of a missed midterm could be added, a makeup midterm is available if a student experiences an extenuating circumstance. To request one, submit an Academic Consideration request through the Student Absence Portal (SAP). If it is granted, the student will write the makeup midterm. Per university policy, this is the one assessment designated as always requiring documentation.

An early sitting is offered for a university-sanctioned schedule conflict (e.g., conflict of two midterms, Varsity competitions) or a religious accommodation that prevents a student from writing the midterm at its scheduled time. If a student requires this accommodation, they must notify their instructor in writing no later than one week before the test.

Assignments
Students are expected to submit each of the 4 assignments by the deadline listed. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit their assignment up to 48 hours past the deadline without a late penalty.
Assignments cannot be handed in after the end of this 48 hour no-late-penalty period. For assignments due before the midterm test, the weight for any assignments not handed in by the end of the 48 hour no-late-penalty period will be re-weighted to the midterm test. For assignments after the midterm test, the weight will be added to the research project write-up.

Deadlines: The 48-Hour No-Late-Penalty Period
All take-home assignments, quizzes, and labs with a stated due date include an automatic 48-hour period after the deadline during which students may still submit without a late penalty. For example, if an assignment is due on November 5, they may submit it until November 7 without penalty. After this 48-hour period, no further submissions will be accepted, and students do not need to request Academic Consideration for a missed deadline; their grade for this component will be calculated as described above. The research project write-up is the one exception; see below.

Research project: Students are expected to submit the research project write-up by the deadline listed. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit this assessment up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 15% per day will be applied for a maximum of 2 further days. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No-Late-Penalty Period (48 hours).

Presentations and Teamwork-Based Assessments
The project presentation and datathon are in-class group work assignments. If extenuating circumstances prevent a student from participating in these assessments, the weight of the missed assessment will be re-weighted to the research project write-up. Students do not need to request Academic Consideration.

6. Additional Statements

6.1 Religious Accommodation

When a recognized religious holiday either requires a student to be absent from the University, or requires or prohibits an activity that makes it impossible for them to complete an academic requirement scheduled that day, they are entitled to accommodation. No student will be penalized for an absence for religious reasons, and an alternative means of satisfying the requirement will be arranged. This accommodation is provided in accordance with the University's policy on Accommodation for Religious Holidays:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

The student should submit their requests through the Student Absence Portal (SAP), identifying the conflict and the specific course component(s) affected (e.g., test, midterm, exam).

> **Midterms and Tests**: If a religious observance conflicts with a midterm test, they must submit their request no later than **one week** before the test. Their instructor will arrange an early sitting of the test. This early sitting is available specifically for this accommodation; see Midterms and Tests above for other circumstances.

Students are responsible for finding out what was covered in any class they miss due to a religious observance, and for taking the appropriate steps to keep up with the course.

If a suitable arrangement cannot be reached between a student and their instructor, they should consult the Undergraduate Chair of the department offering the course, and if necessary, the Associate Dean (Academic) of the Faculty of Science.

For a list of recognized religious observances, please visit the calendars posted on the Equity, Diversity & Inclusion website - https://www.edi.uwo.ca (About Us – Resources – Additional Resources – Calendars).

6.2 Academic 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.

6.3 General Academic Policies

The website for Registrar Services is https://www.registrar.uwo.ca/.

Use of @uwo.ca email: 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 email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formerly known as "appeals")

Policy on Request for Relief from Academic Decision:

https://uwo.ca/univsec//pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Policy on Scholastic Offences:
https://uwo.ca/univsec//pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):
https://uwo.ca/univsec//pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the **possession** of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, hidden cameras and wireless earbuds.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at a student's desk, on their person, or within reach during an assessment will be treated as a scholastic offence, **even if the device is not in use**.

Effective September 2026, the typical penalty for this offence is a failing grade in the course AND a 12-month prohibition on retaking the course.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is their responsibility to review and comply with these expectations.

Use of Generative AI Tools

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations.

Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**.

If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is the student's responsibility to seek clarification before using any AI tools in academic work.

Use of Software for Assessments

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).

Please note that handing in work that is judged to be too similar to a solution available through an online service may 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 assignment in this course have resulted in a loss of more than 10% of the final course grade (that is, more than the weight of that assignment is lost).

In the event 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.

6.5 Support Services

Academic Advising. Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/advising/.

Mental Health Support. 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.

Gender-Based and Sexual Violence. Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If a student has experienced GBSV (either recently or in the past), they can find information about support services for survivors, including emergency contacts, at:

https://www.uwo.ca/health/gbsv/support/index.html.

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

Accessibility for Coursework. A student may contact the course instructor if they require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to them. If they have any questions regarding accommodations, they may also contact Accessible Education at http://academicsupport.uwo.ca/accessible_education/index.html

Learning Development and Success. Learning-skills counsellors at Learning Development and Success (https://learning.uwo.ca) are ready to help students improve their learning skills. The facility offers 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.

Student Councils. Student-run support services are offered by the University Students' Council (https://westernusc.ca) and the Science Students' Council (https://www.westernssc.ca).