Applied Math 4216F Course Outline

1. Course Information

Course Information
Applied Math 4216F, Disease Modelling.
3 lecture hours per week

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 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.

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.

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.

Dates	Tues (2 hours)	Thurs (1 hour)	Assessments/Homework
Sept 10, 12	Welcome and introduction, Input on course design, Review: systems of ODES.	Lecture on basic SIR modelling, equilibria	Input to OWL forum on course design, Matlab "getting started" exercises.
Sept 17, 19	Finalize course design, practice using WALS tech; Active learning podcast and discussion	Matlab tutorial: integrating and plotting systems of ODEs.	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 24, 26	Stability and R0 active learning.	Lecture and active learning on R0.	**Assignment 1 due** (ODEs, equilibria, 10%) Input to forum on COVID models in the literature and news (next 3 weeks)
Oct 1, 3	Models and data: active learning.	Lecture on parameter reduction	Assignment 2 open (stability, R0, 10%)
Oct 8, 10	Parameter fitting: active learning.	Lecture/active learning indentifiability and over-fitting	**Assignment 2 due**, Ass't 3 open (comparing models to data, 10%)
Fall Break			
Oct 22, 24	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, 10%)
Oct 29, 31	Active learning: Sensitivity analysis lab.	Midterm review and problem-solving session	Prepare for midterm exam, Tues Nov 5 (20%)
Nov 5, 7	**Midterm exam**	COVID modelling: group workshop, datathon details.	Take a break! :)
Nov 12, 14	Active learning: TBD	Guest speaker: COVID-19 task force project	Working on group project: preparing for COVID datathon
Nov 19, 21	COVID **datathon**: testing your model!	Active learning: how to give an awesome project presentation	**Assignment 4 due**
Nov 26, 28	Active learning: scientific writing.	Guest speaker: former AM3615 student now working in public health/modelling	Working on group project: presentation and write-up
Dec 3, 5	**Project presentations**	**Project presentations**	Project presentations (10%)

Dec 6			**Project write-up**, Fri Dec 6 (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.

Lectures: 3 hours per week.

4. Course Materials

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

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 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	40%	(4 @10%, pdf uploaded to OWL/Gradescope, see dates above)
Midterm Test	20%	(2 hours in class, closed book with 1 cheat sheet, November 5)
Datathon	5%	(modelling and group summary, November 19)
Project presentation	10%	(20 minute group presentation, Dec 3 and 5)
Research project write-up	20%	(individual write-up of project, December 6)
Engagement	5%	

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 acheive 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 Sunday Dec 8.

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.

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 one 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 one assessment that always requires documentation when requesting Academic Consideration)

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

Evaluation Scheme for Missed Assessments

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 miderm 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.

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

The **project presentation** and **datathon** are in-class group work assignments. If extenuating circumstances prevent a student from partipicating in these assessments, the weight of the missed assessment will be re-weighted to the research project write-up.

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).

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 research project write-up is required to pass the course.
Students who do not achieve 50% on this component will receive 45% as a final course grade.

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 test; if so, this will be announced on OWL ahead of the test. Proctors 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 tests, even for timekeeping purposes. If you have a phone in your pocket during a test 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.

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 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/.