

## Mathematical Biology: COVID-19 modelling and prediction

Course outline for Fall 2021



Although this academic year might be different (again!), Western University is committed to a **thriving campus**. We encourage you to check out the [Digital Student Experience](https://www.uwo.ca/dse/dse/index.html) website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: <https://www.uwo.ca/health/>.

### 1. Technical Requirements:



Stable internet connection



Laptop or computer



Working microphone



Working webcam

### 2. Course Overview and Important Dates:



<b>Delivery Mode</b>	<b>Room: Western Active Learning Space, Univ College-1110</b>
In-person, with possible online components (mostly <b>synchronous</b> )	Tuesdays 10:30-12:30 Thursdays 11:30-12:30

\*Details about design and delivery of the course are listed below in Section 4

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 9	November 1 - 5	December 8	December 9	December 10 - 21

\* November 12, 2021: Last day to drop a first-term half course or a first-term full course without penalty

### 3. Contact Information

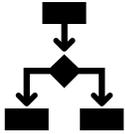
<b>Course Instructor</b>	<b>Contact Information</b>
Prof. Lindi Wahl	lwahl@uwo.ca



## 4. Course Description and Design

**Prerequisites: multi-variable calculus and linear algebra.** Specifically: one of Calculus 2302A/B, 2402A/B, 2502A/B; plus one of Mathematics 1600A/B or Applied Mathematics 1411A/B. A course in differential equations is not a prerequisite but will be helpful. **Please let me know** if you have **not** had exposure to differential equations in your previous courses.

- Pre-work may be assigned and must be completed prior to synchronous sessions
- Attendance, in person or virtually, will be required for some synchronous sessions
- Recordings will not usually be provided for synchronous sessions



All course material will be posted to OWL: <http://owl.uwo.ca>. Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, they can seek support on the [OWL Help page](#). Alternatively, they can contact the [Western Technology Services Helpdesk](#) (by phone at 519-661-3800 or ext. 83800).

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers for use with OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).

## 5. 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.



## 6. Course Content and Proposed Schedule

Dates	Tues (2 hours)	Thurs (1 hour)	Assessments/Homework
Sept 9		Welcome and introduction	Input to OWL forum on course design
Sept 14, 16	Input on course design, active learning podcast and discussion, practice using WALS tech; systems of ODES	Podcast/lecture on basic SIR modelling, equilibria	Input to OWL forum: ODE model Equilibria of in-host model
Sept 21, 23	Lecture/podcast on stability. Stability and $R_0$ active learning.	Lecture/podcast $R_0$ .	Assignment 1 (ODEs, equilibria, 8%) Input to forum on COVID models in the literature and news (next 3 weeks)
Sept 28, 30	Models and data: active learning.	Lecture/podcast: non-dimensionalization	Assignment 2 (stability, $R_0$ , 8%)
Oct 5, 7	Parameter fitting: active learning.	Lecture/podcast: indentifiability, AIC	Assignment 3 (comparing models to data, 8%)
Oct 12, 14	COVID models: literature search and compare.	COVID models: lecture (content TBD depending on models chosen).	Assignment 4 (parameter fitting, 8%)
Oct 19, 21	COVID modelling group workshop	Midterm review and problem-solving session	Prepare for midterm exam, Tues Oct 27 (20%)
Oct 26, 28	Midterm exam	COVID modelling: group workshop	Take a break! :)
<b>Reading Week</b>			
Nov 9, 11	Active learning: how to read a research paper in mathematical epidemiology	Guest speaker: Public Health Agency of Canada project	Working on group project: preparing for COVID datathon
Nov 16, 18	COVID datathon: testing your model!	Guest speaker: former AM3615 student now working in public health/modelling	Assignment 5 (critical review, 8%)
Nov 23, 25	Game Theory	Active learning: how to give a project presentation	Working on group project: presentation and write-up
Nov 30, Dec 2	Project presentations (4)	Project presentations (2)	Project presentations (10%)
Dec 7	Wrap-up		Project write-up, Weds Dec 8 <sup>th</sup> , (25%)

## 7. Participation and Engagement



- Students are expected to participate and engage with content as much as possible
- Students can participate during synchronous sessions or post comments to the OWL forum after watching a recording
- Students can also participate by interacting in the forums with their peers and instructors

## 8. Evaluation



The course grade will be calculated as follows:

Assignments	40%	(5 @ 8%, pdf uploaded to OWL)
Midterm Exam	20%	(2 hrs, in class, open book, Oct 26)
Project presentation	10%	(25 min <b>group</b> presentation)
Research project write-up	25%	( <b>individual</b> write-up of project, Dec 8)
Engagement	5%	

Engagement will include: regular contributions to active learning activities, 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.

- All assignments are due at 11:55 pm EST unless otherwise specified.
- 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.

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

### Information about late or missed evaluations:

- Late assessments without illness self-reports will be subject to a late penalty of 10% / day.
- Late assessments with illness self-reports should be submitted within 24 hours of submission of the last illness self-report.
- An assessment cannot be submitted after it has been returned to the class; the weight will be transferred to the midterm exam if due before the midterm, and to the final project write-up if due after the midterm exam.
- A make-up will be offered for the midterm exam.
- If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered

## 9. Communication:



- Students should check the OWL site every 24 – 48 hours
- Emails will be monitored daily; students will receive a response in 24 – 48 hours
- This course will use the OWL forum for discussions
- Students should post all course-related content on the discussion forum so that everyone can access answers to questions
- The discussion forums will be monitored every 24-48 hours by the instructor

## 10. Office Hours:



- Group office hours, either in person or through zoom, will be held as announced throughout the term. If on zoom, these will be recorded and posted for everyone to view.

## 11. Resources



- All resources will be posted in OWL.
- There is no required textbook.

## 12. Professionalism & Privacy:



Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:

- Students are expected to follow online etiquette expectations provided on OWL
- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- Recordings are not permitted (audio or video) without explicit permission
- Permitted recordings are not to be distributed
- All recorded sessions will remain within the course site or unlisted if streamed

## 13. How to Be Successful in your classes this year:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.



1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
2. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
3. Follow weekly checklists created on OWL or create your own to help you stay on track.
4. Connect with others. Consider forming an online study group and try meeting on a weekly basis for study and peer support.
5. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor.
6. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

## 14. Western Academic Policies and Statements

### Accommodation for Students with Disabilities

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](#).

### Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - an absence must be no more than 48 hours
  - the assessments must be worth no more than 30% of the student's final grade
  - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf) and for the Student Medical Certificate (SMC), see: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

### 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>.

### 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).

### **Special Examinations**

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found here.

### **Academic Offenses**

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

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](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>).

### **Accessibility Statement**

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review The policy on Accommodation for Students with Disabilities.

### **Correspondence Statement**

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.

### **Cell Phone and Electronic Device Policy (for in-person tests and exams)**

For all tests and exams, any electronic devices, i.e., cell phones, tablets, cameras, or iPod are strictly prohibited. These devices **MUST** be left either at home or with the student's bag/jacket at the front of the room and **MUST NOT** be at the test/exam desk or in the individual's pocket. Any student found with one of these prohibited devices will receive a grade of zero on the test or exam. Non-programmable calculators are only allowed when indicated by the instructor. Western is not responsible for stolen/lost or broken devices.

### **Copyright and Audio/Video Recording Statement**

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

### **Rounding of Marks Statement**

All students will be treated equally and evaluated based only on their actual achievement. **Final grades** on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks **WILL NOT** be bumped to the next grade or GPA, e.g. a 79 will **NOT** be bumped up to an 80, an 84 **WILL NOT** be bumped up to an 85, etc.

## **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/>.

The following links provide information about support services at Western University.

[Academic Counselling \(Science and Basic Medical Sciences\)](#)

[Appeal Procedures](#)

[Registrarial Services](#)

[Student Development Services](#)

[Student Health Services](#)

## **15. Notice of Recording**

Any remote learning and in-person learning sessions for this course may be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations, but will never be made publicly available. You will always be notified when a recording will occur. The recordings may be available to other individuals participating in the course for their private or group study purposes. The recordings will be destroyed when they are no longer required for the course. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

## **17. 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.