

**University of Guelph**  
**College of Engineering and Physical Sciences**  
**Department of Mathematics and Statistics**  
**COURSE OUTLINE**  
**MATH 3510 – Biomathematics (0.5 credits)**  
**Winter 2023**

This course will convey the fundamentals of applying mathematical modelling techniques to understanding and predicting the dynamics of biological systems. Students will learn the development, analysis, and interpretation of biomathematical models based on discrete-time and continuous-time models. Applications may include examples from population biology, ecology, infectious diseases, microbiology, and genetics.

Requisites:

MATH\*2270, (ENGG\*1500 or MATH\*1160) - Must be completed prior to taking this course.

### **Teaching team**

Instructor: Christopher van Bommel

Email: [cvanbomm@uoguelph.ca](mailto:cvanbomm@uoguelph.ca)

Office: MacNaughton 524

Office Hours: Will be posted on Courselink

GTA: Matthew Kreitzer, [mkreitze@uoguelph.ca](mailto:mkreitze@uoguelph.ca)

### **Course schedule**

Lectures: Monday, Wednesday, Friday 12:30 PM – 1:20 PM, MINS 017

Final Exam: Thursday, April 13, 2:30 PM – 4:30 PM, Location TBD

### **Learning goals and rationale**

The goals of this course are to develop methods for modelling and simulation and consider their applications to biological phenomena. Knowledge of differential equations is required. By the end of the course, students are expected to be able to:

- Solve difference equations and systems
- Analyze solutions of differential equations and systems qualitatively
- Construct, evaluate, and interpret applied biomathematics models
- Work collaboratively with peers on a research project
- Present a biomathematics model

## Course Resources

**Required Texts:** N/A

**Recommended Texts:** Linda, J. S. Allen, *An Introduction to Mathematical Biology*, Pearson Prentice Hall, 2007

Instructor's notes will be posted online after each class.

## Course Content

Week	Dates	Topics	Reference	Assessment
1	Jan 9 – Jan 13	Linear Difference Equations	1	
2	Jan 16 – Jan 20	Nonlinear Difference Equations: Equilibria and Stability	2.1 – 2.7.0	HW 1 (F)
3	Jan 23 – Jan 27	Dynamical Systems and Single Population Models	2.7.1 – 3.3	
4	Jan 30 – Feb 3	Interacting Population Models, Nonlinear Models	3.4 – 3.8.3	HW 2 (M)
5	Feb 6 – Feb 10	Epidemic Models, Introducing Linear Differential Equations	3.8.4 – 4.4	Test 1 (W)
6	Feb 13 – Feb 17	Analyzing Linear Differential Equations, Introducing Nonlinear ODEs	4.5 – 5.2	HW 3 (F)
	Feb 20 – Feb 24	Reading Week		
7	Feb 27 – Mar 3	Analyzing Nonlinear ODEs	5.3 – 5.8	
8	Mar 6 – Mar 10	Stability and Harvest Models [Mar 10: 40 <sup>th</sup> Class Day]	5.9 – 6.2	HW 4 (M)
9	Mar 13 – Mar 17	Multiple Populations, Movement	6.3 – 6.7.1	HW 5 (W) Abstract (F)
10	Mar 20 – Mar 24	Epidemics and Vaccinations	6.7.2 – 6.9	Test 2 (F)
11	Mar 27 – Mar 31	Project Presentations		Slides (Su)
12	Apr 3 – Apr 5	Project Presentations		Report (W)
	Apr 10 – Apr 14	Review (Apr 10)		Exam (13 <sup>th</sup> )

## Methods of Assessment

Assessment	Weight	Dates
Homework (Best 4 of 5)	20%	Jan 20, Jan 30, Feb 17, Mar 6, Mar 15
Tests (2)	20%	Feb 8, Mar 24
Project	25%	Title and Abstract: March 17 Slides: March 26 Report: April 5
Exam	35%	Apr 13

### **Homework**

Each homework will be posted about a week before the due date, and is due at 11:59 pm (ET) on the date indicated. Solutions to all homeworks should be clearly written or typed in complete sentences, with each step fully explained in order to earn full marks. Students may discuss homework problems provided that each student independently writes a solution to the problem and collaborators are clearly indicated for each problem. You may consult resources to aid your completion of the homework, both those provided as part of the course and those external to the course, provided you do not explicitly search for homework problems and their solutions. Homework is to be uploaded to the corresponding Courselink Dropbox folder.

### **Tests**

Test 1 will be held Wednesday, February 8 in class and will cover the first half of the material (Jan 9 – Feb 6). Test 2 will be held Friday, March 24 in class and will cover the second half of the material (Feb 10 – Mar 22).

### **Project**

Students will be divided (randomly) into teams to study a biomathematics model not presented in the course, in particular its construction, analysis, and interpretation, give an approximately 10 minute presentation in class (will be scheduled March 27 – April 5), and write a report of about 2-3 pages. Teams should provide a title and abstract (brief description) by March 17. Presentation slides or other visual aids should be uploaded by Sunday, March 26, 11:59 pm to the corresponding Courselink Dropbox folder. Presentations will be graded based on organization and clarity. Reports will describe the model and its assumptions, solutions, results, and relevance to course material, and should be uploaded to the Courselink Dropbox folder by Friday, April 5, 11:59 pm. Reports will be graded based on organization and understanding demonstrated. Further details will be provided.

### **Grading**

It will be our aim to return the results of homework and tests within 5 business days.

## **Course and University Policies**

### **E-mail Communication**

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

### **When You Cannot Meet a Course Requirement**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for [Academic Consideration](#).

### **Drop Date**

The last date to drop one-semester courses, without academic penalty, is the last day of classes. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. For regulations and procedures for Dropping Courses, see the [Undergraduate Calendar](#).

### **Copies of out-of-class assignments**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **Accessibility**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

### **Academic Misconduct**

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

### **Recording of Materials**

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### **Resources**

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

### **Disclaimer**

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

### **Illness**

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

### **COVID-19 Safety Protocols**

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, that these guidelines may be updated as required in response to evolving University, Public Health or government directives.