

Faculty of Science Course Syllabus  
Department of Mathematics and Statistics  
**MATH 2300 - Mathematical Modelling** Winter 2024

*Dalhousie University sits on the ancestral and unceded territory of the Mi'kmaq nation. We are all Treaty people.*

## 1 General Information

**Course Description:** The focus of this course will be the construction and analysis of mathematical models. Focus will be given to the use of computer simulations. Programming in Python will be covered. Google offers a service called Colab which allows you to execute Python code in a browser.

**Textbook:** A Course in Mathematical Modeling by Douglas Mooney and Randall Swift.

**Calculators:** Calculators are not permitted during the midterm and final exam. Answers may be left unsimplified.

## 2 Instructors & course delivery details

**Instructor** David Iron

**Times** Monday, Wednesday, Friday at 9:35 – 10:25

**Location** Dunn 302

**Web Page** Dalhousie's Online Learning System

**Office hours** Wednesdays 3:30-5 Thursday 3:30-5

**Office** Chase 322 or online

## 3 Course Assessment

**Homework** Homework assignments can be found on the course Brightspace page in the content/homework section. Assignments are issued on a roughly weekly basis. Many of the assignments will have a programming component. Full listing of the code and output must be added to the assignments.

**Midterm Test** The midterm test is on Friday, February 16 during class time.

**Final Exam** The final exam is 3 hours long. The date and time for this exam is set by the registrar during the official Dalhousie exam period from April 13-25. If you plan to depart from campus at the end of the semester, please make your plans after the registrar has announced the exam schedule, or plan to leave after April 26. Unfortunately, there are no opportunities to write the exam early.

## 4 Grading

**Homework** 40%

**Term Test** 20%

**Final Exam** 40%

## 5 Grading Scheme

The grading scheme is as follows:

A+	A	A-	B+	B	B-	C+	C	C-	D	F
[90, 100]	[85, 90)	[80, 85)	[77, 80)	[73, 77)	[70, 73)	[65, 70)	[60, 65)	[55, 60)	[50, 55)	[0, 50)

## 6 Course topics and approximate schedule

**week 1** Introduction to discrete dynamical systems. Use of Python. Chap 1.1-1.4

**week 2** Bifurcations in discrete systems. Chap 1,5-1.6

**week 3** Discrete systems and randomness. Chap 2.1-2.2

**week 4** Simulation Random Processes. Chap 2.3

**week 5** Markov Processes Chap 3

**week 6** Differential Equation Chap 5.1-5.2

**week 7** Nonlinear Differential Equations Chap 5.3

**week 8** Review for Midterm

**week 9** Numerical Solutions to Differential Equations Chap 5.4

**week 10** Queueing Theory Chap 6.1-6.2

**week 11** Queueing Theory Simulations Chap 6.3-6.6

**week 12** Birth death process. Chap 6.7

## 7 Missed or Late Academic Requirements

In the event that you are absent for three days or fewer resulting in missed or late academic requirements, you will be required to submit a Student Declaration of Absence Form to your instructor, see: [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html)

We understand that circumstances can arise that can interfere with completing your work. We will drop your two lowest homework scores to function as a buffer for all.

Midterm and Final exams: In the event that you are unable to attend our midterm or final exam, please notify your instructor via email in advance to determine what alternative.

## 8 Student Accommodations

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic under the Nova Scotia Human Rights Act. Students who require academic accommodation for either classroom participation or the writing of tests, quizzes and exams should make their request to the Office of Student Accessibility & Accommodation (OSAA) prior to or at the outset of each academic term. Please visit

[https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

for more information and to obtain Form A - Request for Accommodation. A note taker may be required to assist a classmate. There is an honorarium provided for the note taker of \$75-100/course/term. If you are interested, please contact OSAA at [access@dal.ca](mailto:access@dal.ca) or 494-2836 for more information. Lectures and tutorials will not be recorded, but please speak with your instructor if you would like to use your own recording device in class.

## 9 Learning Objectives

- To enhance your mathematical tool kit to help model problems in the world around you.
- To develop an understanding of applications of dynamical systems, equilibria, and stability in science.
- Introduction to programming concepts and the use of a computer to solve mathematical problems.
- To build upon your logical reasoning, and both critical and analytical thinking.

## 10 Course Policies related to Academic Integrity

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

## 10.1 Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Information: [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

## 10.2 Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia). Information: [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html) Student Code of Conduct Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. Code: [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

## 10.3 Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness Statement: <http://www.dal.ca/cultureofrespect.html> Recognition of Mi'kmaq Territory Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)). Information: [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html) Important Dates in the Academic Year (including add/drop dates) [https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html) University Grading Practices [https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-p.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-p.html)

# 11 Student Resources and Support

## 11.1 Advising

General Advising [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)  
Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html>  
Indigenous Student Centre: [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)  
Black Students Advising Centre: [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)  
International Centre: [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

## 11.2 Academic supports

Library: <https://libraries.dal.ca/>  
Writing Centre: [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)  
Studying for Success: [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)  
Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>  
Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

### 11.3 Other supports and services

Student Health & Wellness Centre: [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

### 11.4 Safety

Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Dalhousie COVID-19 information and updates: <https://www.dal.ca/covid-19-information-and-updates.html>

## 12 Course Policies on missed or late academic requirements

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