

## Math 4200/5200 - Qualitative Theory of Dynamical Systems

### 1 Course Outline

Text: There is no required text for this course, but the following texts should be available in the library and may be used as references.

- D. K. Arrowsmith and C. M. Place [1990], *An Introduction to Dynamical Systems*, Cambridge Press
- J. Hale and H. Kocak [1991], *Dynamics and Bifurcations*, Springer-Verlag
- S. Wiggins [1990], *Introduction to Applied Nonlinear Dynamical Systems and Chaos*, Springer-Verlag

This course will focus on finding the behaviour of dynamical systems which cannot be solved exactly. The course will begin with an introduction to dynamical systems (discrete and continuous). We will consider local bifurcations and finally global dynamics such as the saddle-loop bifurcation and the Smale horseshoe map. Other topics, to be chosen by class interest, may be considered.

All homework assignment and handouts will be available from the web page in pdf format. If you have any problems downloading or viewing/printing these documents please let me know.

### 2 General Information

**Instructor** David Iron

**Times** Tuesday and Thursday 11:30-1 **Location** The

lectures will be held in Chase 227 **Web Page** Brightspace

Course Page

**Office hours** Wed. 2:30-4:00 Thurs. 11:00-12:30

### 3 Instructor Information

**Name** David Iron

**Office** Chase 308

**Phone** (902) 494-2385

**email** iron@mathstat.dal.ca

### 4 Grading

**Homework** 60%

**Final Project** 40%

For students enrolled in 4200, each homework will contain optional bonus questions. For students enrolled in 5200 all of the assignment questions will be graded normally.

The final project will be composed of both a written report and an oral presentation. The written report will be due on the last day of classes and should be roughly 15-20 double spaced pages in length. It may be typed, Latexed or handwritten as long as it is legible. Original mathematical results are not required, but the mathematics should be a relatively current. I will supply a list of papers you may wish to choose your topics from. A some point in the term every student must discuss and get approval of a research topic for their final paper.

The oral presentations should be roughly 20 minutes in length and will all take place during the final week of classes.

The course will be delivered live. If there is a student needing copies of the lecture notes contact me and I will try and arrange to have notes posted.

## 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 Final Notes

- Late homework will be penalized at 10% per day.
- Homework will be accepted as on time up to 6:00pm on the due date. Email submissions will be accepted, but must be in either pdf or postscript format. I will not accept Word documents or any other proprietary formats.
- The university policy states that all cases of academic misconduct *must* be handled through official channels. I have no latitude in this matter. I do encourage people to work in groups, but I must insist that each student write up their own homework. Please read the paragraph on academic honesty on pages 25-26 in the Calendar.
- Students with permanent or temporary disabilities who would like to discuss classroom or exam accommodations are asked to contact me as soon as possible. For information on available services see <http://www.dal.ca/~services/ssd.html>.

**Faculty of Science Course Syllabus (Section B)**  
**Fall/Winter 2022-23**

*Math 4200/5200 - Qualitative Theory of Dynamical Systems*

**University Policies and Statements**

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

**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)

**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)

**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://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loadusercredits=False>

**University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Faculty of Science Course Syllabus (Section C)**  
**Fall/Winter 2022-23**

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## **Student Resources and Support**

### **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/undergrad-students/degree-planning.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)

### **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>

### **Other supports and services**

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

### **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>