

Faculty of Science Course Syllabus (Part A)

Math 2135, Linear Algebra

Winter 2021

Instructor: Prof. Peter Selinger
Email: selinger@dal.ca (please mention "2135" on the subject line)

Lectures: MWF 2:35-3:25 on Collaborate Ultra.
Link: <https://ca.bbcollab.com/guest/f1c41f9f7caf41fb826a16395776de50>

Office hours: M 12-1, W 11-12 on Collaborate Ultra.
Link: <https://ca.bbcollab.com/guest/d8c2511564cb43a0ac9c7acd14f81893>

Course Description

This course is a continuation of Math 1030 with an emphasis on foundations and the theory of vector spaces and linear transformations. Additional topics include inner product spaces, symmetric and orthogonal transformations, bilinear forms, similarity and diagonalization, the solution of linear differential equations, and various applications in mathematics, physics and computer science.

Course Objectives/Learning Outcomes

The difference between Math 2040 and this course is that Math 2135 is a proof-based course. Not only will proofs be given in class, but students will learn to write proofs themselves. For many students, it is the first introduction to mathematical proofs. The course is suitable for honours students and others with an interest in rigorous mathematics.

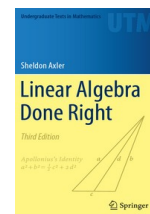
Topics include: Complex numbers, fields, vector spaces, subspaces. Span and linear independence, bases, dimension. Linear maps, null space and range, dimension theorem, matrices, isomorphism of vector spaces, products and quotients. Polynomials. Eigenvalues, eigenvectors, and invariant subspaces, diagonalizability. Inner product spaces, orthogonality, orthonormal bases, Gram-Schmidt orthogonalization procedure. Unitary, self-adjoint, and normal operators, the spectral theorem, positive operators and isometries. Trace and determinants. Solution of linear differential equations.

Course Prerequisites

Math 1030 and Math 1000. Exclusions: Math 2040.

Course Materials

- Textbook: "Linear Algebra Done Right", 3rd edition, by Sheldon Axler. There is also a set of videos to accompany the book: <http://linear.axler.net/LADRvideos.html>
- Course website on Brightspace is accessed through dal.brightspace.com



Course Assessment

Participation	5%	Participation in class and discussion boards.
Homework	30%	Assigned throughout the semester, to be handed in on Brightspace.
Module tests 1-3	45%	February 1, March 1, March 22.
Final Exam	20%	Scheduled by the Registrar's Office

The module tests and final exam will be given as virtual take-home exams. You will be given a 24-hour period in which to complete each module test, and a 48-hour period for the final exam.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

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

Course Policies

1. Homework: You **are permitted** to work collaboratively with other students in this class on homework. I have created some virtual study spaces on Brightspace where you can meet and work. Regardless of whom you work with, each student must complete their own individual homework. Homework must be written in your own words. You are **not permitted** to copy answers from the internet or to ask anybody on the internet for help with your homework. The only exception to this is the Math Learning Centre, which is currently running virtually through Collaborate Ultra.
2. Module tests and final exam: You are **not permitted** to talk to any person other than me, Peter Selinger, about any aspect of a module test or final exam. You **are permitted** to consult your textbook, class notes, your own notes, and any handouts from this class including solutions to homework problems. You are **not permitted** to look up answers on the internet or to ask anybody on the internet for help with your module tests or final exam.
3. We will use plagiarism software and other technological means to detect academic integrity issues.
4. Late homework will not be accepted except with the instructor's prior permission.
5. A missed module test cannot be written at another time. If you miss a module test without prior permission, then it will count as a 0. Exceptions are made in two cases: (1) if you obtain the instructor's prior permission to miss a test, or (2) if you submit a Student Declaration of Absence form prior to the test. In these cases, the weight of the missed test will be shifted to the final exam (e.g., the final exam will then count 35% instead of 20%). There is no make-up option for the final exam except in cases of an officially valid excuse such as illness, with a Student Declaration of Absence form.
6. 5% of your grade are for participation. There are at least three ways to participate: you can ask or answer a question in class; you can ask or answer a question in office hours; or you can ask or answer a question in the Brightspace discussion forum. Each time you do so, you receive 1 participation point, up to a maximum of 5 points. 5 points equals 5%. I reserve the right to not award points in case of frivolous activity (e.g.: don't ask what is 1+1; don't ask questions you already know the answer to; don't answer your own question just to get a point; don't conspire to answer a friend's question just to get a point, etc. The point is *participation*).
7. You are welcome to email me with questions or issues that are private or personal to you, or in case you should have any questions during a module test or exam. When asking math-related questions in the normal course of things, please use the discussion forum on Brightspace. This way, you can get participation points, and others can benefit from seeing your question and any answers that are already there. You are welcome and encouraged to answer each other's questions and be helpful, but obviously don't just post the answers to the homework in the discussion forum.
8. Lectures will be given live, and will be recorded. You are not strictly required to attend the live lectures, but I encourage you to do so. Experience shows that students who come to lectures tend to learn more and do better.

Course content

We will cover approximately the following textbook chapters: 1A-C, 2A-C, 3A-D, 4, 5A, 5C, 6A-C, 7A-C.

Faculty of Science Course Syllabus (Part B)

Math 2135, Linear Algebra, Winter 2021

University Policies and Statements

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

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021). Information on regular policy, including the use of the Student Declaration of Absence can be found here: https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html.

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

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

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

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).

Information: 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

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Student Resources and Support

Advising

General Advising 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

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: 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

Studying for Success: 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/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

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>