



MATH 4140

Introduction to Functional Analysis

Winter 2024

INSTRUCTOR: Andrea Fraser, Assoc. Professor
Chase Building, Room 206 (by the central stairwell)
494-3062
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OFFICE HOURS: Office hours will be held in person or via Collaborate Ultra, booked by appointment or as posted on Brightspace. You can also seek help by email.

LECTURES: Monday, Wednesday, Friday: 8:35am - 9:25am.
Chase 319 (Colloquium Room)

COURSE DELIVERY: Lectures will be held live and will not be recorded. Delivery will be in-person in the classroom, with the exception of occasional lectures delivered remotely, synchronously streamed on Collaborate Ultra (for example, on days when weather or other factors might reduce in-person class attendance).

COURSE MATERIALS: All course content will be covered in lectures, course handouts, and the textbook. Handouts will be distributed in class or posted on Brightspace; those that are distributed in class will be available once, at the start of the lecture, and will not be posted online.

To submit assignments you must upload your answers to Brightspace, handwritten on the question sheets. You will need: a tablet; or a printer and scanner/camera/cellphone.

REQUIRED TEXT:

Elementary Functional Analysis, Barbara MacCluer (Springer).

COURSE ASSESSMENT:

Eight assignments: (two 24hr-late submissions allowed; see course policies.)

100%

due Jan 24, Feb 5, Feb 14, Mar 1, Mar 11, Mar 20, Apr 1, Apr 9

Available approximately a week in advance. Must be submitted on Brightspace by 8:35am.

COURSE DESCRIPTION:

An introduction to the basic principles of functional analysis including the following topics: Banach and Hilbert spaces, bounded operators and adjoints, bounded linear functionals, Hahn-Banach theorem, principle of uniform boundedness, open mapping and closed graph theorems, compact operators, spectral theorem for compact self-adjoint operators on a Hilbert space. Further topics may include: weak* topology, Alaoglu theorem.

PREREQUISITES: MATH 3502.03

CROSS-LISTING: MATH 5140.03

COURSE OBJECTIVES: This course provides an introduction to the basic concepts and methods of functional analysis.

CONVERSION OF GRADES: Follows the Dalhousie Common Grade Scale.

90 – 100 A+	77 – 79.9 B+	65 – 69.9 C+	50 – 54.9 D
85 – 89.9 A	73 – 76.9 B	60 – 64.9 C	0 – 49.9 F
80 – 84.9 A-	70 – 72.9 B-	55 – 59.9 C-	

COURSE POLICIES:

Course announcements: Any announcements regarding the course will be made in class, on Brightspace, or by email. You are expected to attend class and to check Brightspace and email regularly. If you miss or are late for a class, it is your responsibility to consult your peers to find out what you missed. If you do not use your official Dalhousie email address, you should set a forward on it to an address you do use.

Working on assignments: Assignments are designed to help you learn by prompting you to explore concepts on your own and helping you to familiarize yourself better with material. The process of interpreting what is being asked in a problem and establishing what you must show in order to solve it can be difficult at first but with perseverance will force you to improve your grasp on terminology and the subtleties of logic involved. Rather than turning to the internet or other sources of help when you are given a question, it is important that you make the effort to delve into it by yourself. If you are still having difficulty after making a genuine effort, you may consult your instructor for guidance and hints. You may also discuss assignment questions with your classmates, but you should not leave a discussion with anything in writing; your written work must be your own. You may not seek answers to assignment questions elsewhere. Attempting to solve a problem, whether you succeed or not, is a valuable learning experience which will give meaning and purpose to results you have learned, solidifying your understanding of the subject and helping you to think and question on your own.

Plagiarism and cheating: When writing assignments, you may consult course material, and you are allowed to discuss questions with classmates as outlined above. But obtaining outside help on assignment questions (for example, at the Learning Centre, from a higher level student, from non-course websites, online chat or discussion forums, etc.) is considered cheating. Use of solutions to tests or assignments from a previous year to which you have somehow gained access is strictly forbidden and considered plagiarism. Copying solutions from textbooks or websites and presenting them as your own is plagiarism. Any student suspected of violating these rules will be required to pass an oral exam to demonstrate a full understanding of the work submitted. Further action may then be taken following Dalhousie's official plagiarism and cheating policy.

Assignment policy: Each assignment must be completed according to the submission guidelines posted on Brightspace, and submitted by the due time. At your discretion you may submit up to two assignments 24 hours late. Do not leave submission of assignments until the last minute. You have approximately a week for each assignment and are expected to submit your work well before the last minute, to allow for routine technical hassles involved with online submission. Provision has already been made for late submission of two assignments, and no other late assignments will be accepted for any reason whatsoever.

STUDENT DECLARATION OF ABSENCE: No *Student Declaration of Absence* forms will be accepted.

UNIVERSITY POLICIES AND STUDENT RESOURCES: Information on Dalhousie policies and student resources can be found under Syllabus in the Table of Contents of the MATH 4140 course space on Brightspace.

University Policies and Statements

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

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 at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.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. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

Student Use of Online Resources from Outside Canada

Students connecting to online resources from outside Canada are responsible for ensuring awareness and compliance with any applicable laws in the country from which they are connecting.