

Introduction to Applied Geophysics Syllabus

Department of Earth and Environmental Science
ERTH 2270 / PHYS 2270 Winter 2024

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.

Course Instructor(s)

Name	Email	Office Hours
Alexandre Plourde	ap.plourde@dal.ca	Monday 12:00--14:00 LSC 3085 (Biology)
Elahe Sirati	el430484@dal.ca	TBD

Course Description

An introduction to using physical principles to explore the Earth's subsurface, with an emphasis on near-surface applications. Topics include seismic, gravity, magnetic, electrical, and electromagnetic surveying techniques, and some examples of their applications. The geophysics field school, normally conducted during the last week of April, is an integral part of this course.

Course Prerequisites

First-year earth science, physics, and math: *ERTH 1080.03 or (SCIE 1506.03/SCIE 1507.03) and MATH 1000.03 and (PHYC 1190.03/ PHYC 1290.03 or PHYC 1310.03/PHYC 1320.03 X/Y)*

Student Resources

Students are encouraged to come to the office hours, although we will make a reasonable effort to respond to questions outside this time. Feel free to email questions and we will either respond via email or try to arrange a meeting time. Please find a more exhaustive list of available resources (compiled by the Faculty of Science) at the end of this document.

Course Structure

Lectures

Monday and Wednesday, 14:35 – 15:55, LSC-Oceanography O3655

Laboratories/Tutorials

Wednesday, 10:35 – 11:25, LSC-Biology B2012

Course Materials

Textbook

Burger, Robert, E., Sheehan, Anne F. and Jones, Craig, H., *Introduction to Applied Geophysics; Exploring the Shallow Subsurface*, W. W. Norton & Company, New York - London, 2006.

The textbook is required, although note a PDF version of it is available on the online platform *Scribd*.

Assessment

The final grade of the class will be based on the following:

Assignments/Labs	30%
Mid-term	20%
Final Examination	35%
Field experiment report (April)	15%

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Assignments handed in late will be deducted 10% per day. Assignments handed in more than 5 days late will not be graded. A make-up test might be possible if you must miss the mid-term or final exam due to illness or emergency, although this will be handled on a case-by-case basis. Please let the instructor know as soon as possible if you must miss any form of assessment.

Course Policies related to Academic Integrity

Although students are encouraged to work together to solve problems in the labs/assignments, as well as make use of the provided software, we expect that what they submit reflects their own work and their own learning. See the below for more information on Dalhousie's academic integrity policy.

Learning Objectives

ERTH/PHYS 2270 covers commonly used geophysical survey techniques including seismic refraction, seismic reflection, resistivity, gravity, magnetics and electromagnetics. Focus is on their application in the shallow crust, where most of the exploratory work is carried out.

Computer Usage:

Students will use their personal computers to solve computational problems handed out as part of their assignments.

Labs/Assignments:

Students will learn how to solve various numerical problems and how to use the provided software.

Course Content

This is an approximate schedule of the course delivery and is subject to change.

Lecture#	Date	Chapters of the textbook	Lab #
1	Jan. 8	Course policy and self-introduction	
2	Jan. 10	Overview of the course; chapter 1	
3	Jan. 15	Seismic waves and wave propagation; chapter 2.1	
4	Jan. 17	Ray paths in layered media; chapter 2.2	1
5	Jan. 22	Attenuation, amplitude, and acquisition; chapters 2.3, 2.4, 2.5	
6	Jan. 24	Refraction: horizontal interfaces; chapters 3.1, 3.2, 3.3, 3.4	2
7	Jan. 29	Refraction: dipping and nonideal; chapters 3.5, 3.6, 3.7.1, 3.7.2	
8	Jan. 31	Refraction: nonideal and field procedures; chapters 3.7.3, 3.7.4, 3.8, 3.10, 3.11	3
9	Feb. 5	Reflection: single interface; chapter 4.1	
10	Feb. 7	Reflection: multiple interfaces; chapter 4.2	4
11	Feb. 12	Hands-on practices and review of all previous lectures	
12	Feb. 14	Reflection: Field procedures; chapters 4.4 and 4.5	5
	Feb. 19–23	Winter Break	
13	Feb. 26	Reflection: computer processing; chapter 4.6	
	Feb. 28	MID-TERM EXAM	
14	Mar. 4	Review of mid-term and intro to electrical resistivity; chapters 5.1, 5.2	
15	Mar. 6	Resistivity: Current flow and electrical potential; chapters 5.3, 5.4, 5.5	6
16	Mar. 11	Resistivity: Field procedures; chapters 5.8, 5.9, 9.10	
17	Mar. 13	Gravity: fundamentals; chapters 6.1, 6.2, 6.3	7
18	Mar. 18	Gravity: correction; chapters 6.3, 6.4	
19	Mar. 20	Gravity: anomalies and interpretation; chapters 6.5, 6.6, 6.7	8
20	Mar. 25	Magnetics: fundamentals and field variations; chapter 7.1, 7.2	
21	Mar. 27	Electromagnetic: GPR; chapter 8.4 & Review of the whole content	9
22	Apr. 1	<i>BUFFER / MAKE-UP</i> , or some example applications and studies	
23	Apr. 3	Field experiments: introduction and hands-on practices	
	Apr. ~24	HANDS-ON SEISMIC FIELD EXPERIMENT	

University Policies and Statements

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.

Faculty of Science

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

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

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

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

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>



Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

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

International Centre: https://www.dal.ca/campus_life/international-centre.html

South House Sexual and Gender Resource Centre: <https://southhousehalifax.ca/about/>

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

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

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

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

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