

**Faculty of Science Course Syllabus (Section A)
Department of Earth and Environmental Sciences**

*The Solid Earth - EARTH 3270
Winter Term 2025*

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor(s): Miao Zhang, miao.zhang@dal.ca

Lectures: 1.5 hours/lecture, two lectures/week

Tutorials: 1.0 hour/week

Course delivery: In-person

Course Description

This course aims to understand the structures and dynamics of the Solid Earth system from the surface to the inner core and from the ocean to the continent. Topics covered will include the internal structure of the Earth, plate tectonics, earthquakes, seismology, gravity, magnetic field, heat flow, and mantle convection.

Course Prerequisites

Mathematics: MATH 1000 or MATH 1215, and MATH 1010.

Physics: PHYC 1190/1290 (preferred) or PHYC 1310/1320.

Course Objectives/Learning Outcomes

By the end of this course, students will be able to:

- Explain fundamental earth science concepts and phenomena using sketches.
- Gain knowledge of plate tectonics and its driving forces.
- Understand the Earth as a unified dynamic system.
- Appreciate the importance of multidisciplinary approaches in Earth sciences.
- Read, analyze, and critique scientific papers, and effectively communicate scientific concepts.

Course Materials

Textbook 1 – C. M. R. Fowler, *The Solid Earth: An Introduction to Global Geophysics*, Cambridge University Press, 2nd Edition, 2004 (PDF version is available online).

Textbook 2 – R. J. Lillie, *Whole Earth Geophysics: An Introductory Textbook for Geologists and Geophysicists*, Prentice-Hall, Upper Saddle River, New Jersey 07458, 1999 (PDF version is available online).

Paper readings will be posted on Brightspace.

Course Assessment

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

Four Assignments (TBD)	36%
Mid-term (TBD)	20%
Final Examination (TBD)	20%
Project presentation (TBD)	10%
Quizzes	10%
Participation	4%

Detailed descriptions could be found as below:

1. Assignments

Assignment 1: Structure of the Earth and plate tectonics, Lectures 2-7, Due date: TBD	(9%)
Assignment 2: Earthquakes and seismology, Lectures 8-12, Due date: TBD	(9%)
Assignment 3: Gravity and magnetism, Lectures 13-16, Due date: TBD	(9%)
Assignment 4: Heat flow and mantle convection, Lectures 17-21, Due date: TBD	(9%)

Assignments will involve problem-solving and/or paper review.

2. Mid-term and final examinations

Both exams are closed-book. The mid-term will be in class, and the final exam will be scheduled by the registrar. (20% x2)

3. Project presentation

Students will choose research topics, collect journal papers, and present them in class. The selection of research topics and paper should be done in consultation with the instructor (at least two weeks in advance). (10%)

4. Quizzes

Test the understanding of the past lectures before the class (note: not every class, without prior notice). (10%)

5. Participation

Active participation in discussions and question sessions. (4%)

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

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

Course Policies

Assignments handed in late will be deducted 10% per day. Assignments handed in more than 5 days late will not be graded. There will be no make-up mid-term or final exams. If you must miss an exam due to illness or unavoidable circumstances (please notify the instructor in advance), the missing exam will have its weight redistributed among your assignments. For example, if you missed the final exam, the 20% weight will be equally distributed among your four assignments. Students must use the Student Declaration of Absence form for missed lectures or tutorials (at most twice). If you have absences lasting longer than three consecutive days, you need to contact the instructor and your advisor to explore other accommodations. The use of AI bots (e.g., ChatGPT) will not be allowed. Anti-plagiarism software will be applied. Additional information is provided in the supplemental syllabus.

Course Content

Date	Lecture#	Lecture content	Assignment#
xx	Lecture 1	Course policy and introduction of the course	
xx	Lecture 2	Internal structure of the Earth: homogeneity	
xx	Lecture 3	Internal structure of the Earth: heterogeneity	
xx	Lecture 4	Plate tectonics: geometry and boundaries	
xx	Lecture 5	Plate tectonics: mechanics and kinematics	
xx	Lecture 6	Oceanic lithosphere	
xx	Lecture 7	Continental lithosphere	Assignment#1
xx	Lecture 8	Earthquakes: release of Earth's energy	
xx	Lecture 9	Seismic wave propagation	
xx	Lecture 10	Probing the shallow Earth: active source seismology	
xx	Lecture 11	Probing the deep Earth: earthquake seismology	
xx	Lecture 12	Review and discussion: Earth's structures, tectonics, and earthquakes	Assignment#2
xx	Mid-term Exam		
xx	Lecture 13	Global gravity	
xx	Lecture 14	Gravity anomalies and their relation to global tectonics	
xx	Lecture 15	Global magnetic field	
xx	Lecture 16	Paleomagnetic evidence for plate tectonics	Assignment#3
xx	Lecture 17	Introductory heat flow	
xx	Lecture 18	Sources and conduction of heat flow	
xx	Lecture 19	Heat flow and tectonics	
xx	Lecture 20	Mantle convection: Earth's geological engine	
xx	Lecture 21	Overview: understand the Earth as a unified dynamic system	Assignment#4
xx	Lecture 22	Project presentation and open discussion	
xx	Lecture 23	Project presentation and open discussion (cont.)	

Faculty of Science Course Syllabus (Section B)**Winter 2024-25***The Solid Earth - EARTH 3270***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

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://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

Faculty of Science Course Syllabus (Section C)**Winter 2024-25***The Solid Earth - EARTH 3270***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/undergrad-students/degree-planning.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.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>**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>