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

The Solid Earth - ERTH 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


Paper readings will be posted on Brightspace.

Course Assessment
The final grade of the class will be based on the following:
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).

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**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Numerical Grade</th>
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<tbody>
<tr>
<td>A+</td>
<td>(90-100)</td>
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<tr>
<td>A</td>
<td>(85-89)</td>
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<tr>
<td>A-</td>
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<td>B+</td>
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<td>B</td>
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<td>B-</td>
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<td>C+</td>
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<td>C</td>
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<td>C-</td>
<td>(55-59)</td>
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<td>D</td>
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<td>F</td>
<td>(&lt;50)</td>
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**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

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture#</th>
<th>Lecture content</th>
<th>Assignment#</th>
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</thead>
<tbody>
<tr>
<td>xx</td>
<td>Lecture 1</td>
<td>Course policy and introduction of the course</td>
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<td>xx</td>
<td>Lecture 2</td>
<td>Internal structure of the Earth: homogeneity</td>
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<td>xx</td>
<td>Lecture 3</td>
<td>Internal structure of the Earth: heterogeneity</td>
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<td>xx</td>
<td>Lecture 4</td>
<td>Plate tectonics: geometry and boundaries</td>
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<td>Lecture 5</td>
<td>Plate tectonics: mechanics and kinematics</td>
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<td>xx</td>
<td>Lecture 6</td>
<td>Oceanic lithosphere</td>
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<td>xx</td>
<td>Lecture 7</td>
<td>Continental lithosphere</td>
<td>Assignment#1</td>
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<td>xx</td>
<td>Lecture 8</td>
<td>Earthquakes: release of Earth's energy</td>
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<td>xx</td>
<td>Lecture 9</td>
<td>Seismic wave propagation</td>
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<td>Lecture 10</td>
<td>Probing the shallow Earth: active source seismology</td>
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<td>xx</td>
<td>Lecture 11</td>
<td>Probing the deep Earth: earthquake seismology</td>
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<td>xx</td>
<td>Lecture 12</td>
<td>Review and discussion: Earth's structures, tectonics, and earthquakes</td>
<td>Assignment#2</td>
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<td>xx</td>
<td>Mid-term Exam</td>
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<td>xx</td>
<td>Lecture 13</td>
<td>Global gravity</td>
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<td>Lecture 14</td>
<td>Gravity anomalies and their relation to global tectonics</td>
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<td>xx</td>
<td>Lecture 15</td>
<td>Global magnetic field</td>
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<td>Lecture 16</td>
<td>Paleomagnetic evidence for plate tectonics</td>
<td>Assignment#3</td>
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<td>xx</td>
<td>Lecture 17</td>
<td>Introductory heat flow</td>
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<td>xx</td>
<td>Lecture 18</td>
<td>Sources and conduction of heat flow</td>
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<td>xx</td>
<td>Lecture 19</td>
<td>Heat flow and tectonics</td>
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<td>xx</td>
<td>Lecture 20</td>
<td>Mantle convection: Earth's geological engine</td>
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<td>Lecture 21</td>
<td>Overview: understand the Earth as a unified dynamic system</td>
<td>Assignment#4</td>
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<td>Lecture 22</td>
<td>Project presentation and open discussion</td>
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<td>xx</td>
<td>Lecture 23</td>
<td>Project presentation and open discussion (cont.)</td>
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Faculty of Science Course Syllabus (Section B)
Winter 2024-25
The Solid Earth - ERTH 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.

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)

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 - ERTH 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


Other supports and services

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

Student Advocacy: https://dsu.ca/dsas


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