

Engineering Geoscience

ERTH 2404 - Winter 2023

Why should future professionals want to take a course in Earth Science? Here's why: many aspects of your future profession are connected in some way to the physical Earth; its lands, oceans, atmosphere, plants and animals. In addition, the materials used for our homes and offices, the clothes that we wear, cellphones and computers, our sources of energy, our drinking water, the air that we breathe, and the food that we eat, are all in some way derived from our planet. The Earth Sciences offer an integrated and interdisciplinary approach to understanding Earth, and apply knowledge from biology, chemistry, physics, ecology, mathematics and computer science to tackle complex issues. If we wish to maintain and improve the quality of life on Earth, as its population exceeds 8 billion people, then we are required to understand and appreciate the complex processes that control our planet.

Earth Science benefits everyone! Understanding Earth Science empowers you to think globally and act locally. Only if you understand the Earth system can you make informed decisions about issues that impact our daily lives. This course may help you apply geological knowledge to engineering problems: in the designing and locating reservoirs; in integrating of geological factors important in slope stability for construction purposes; and in considering geohazards such as earthquakes, floods, mass movements, volcanic activity or subsidence in areas considered for roads, pipelines, or other engineering works.

This course will provide you with an overview of the Earth system, mostly the solid part of our planet. We will discuss the origin of the Solar System; the inner layers of the Earth; geologic time and radiometric dating of rocks and minerals; how minerals and rocks form; the theory of plate tectonics; rocks, including the major igneous, sedimentary and metamorphic rock types; the physical properties of the Earth, including magnetism, earth resources, including water, metals, and energy, and potential resources of the future. As often as possible, we will illustrate each process with field examples and will relate it to the geology of Canada. In each section, we will examine how this knowledge affects engineering projects using historical cases.

Learning Outcomes:

1. Explain the different properties of earth minerals and rocks.
2. Understand global and local geological processes.
3. Relate how geologic structures and processes influence engineering design.
4. Describe the geological processes that create natural hazards and risks.
5. Explain the impact of geological processes on people, infrastructure, and engineering design.

6. Outline the engineering strategies that can mitigate the impact of geohazards.

Important Information:

Professor: Dr. Maurice Lamontagne (mauricelamontagne@cunet.carleton.ca)

TAs: TBA (will be posted on Brightspace).

Lectures: Thursdays from 14:35 to 17:25
Jan 12 – April 13, 2023 (Winter Break on Feb. 23rd)
Southam Hall Theatre B (THB SA)

Availability: Questions on lecture material should be sent to Maurice Lamontagne (mauricelamontagne@cunet.carleton.ca): I will respond to emails within 2 business days (i.e. except during weekends and holidays).
Please send me a reminder if I have not responded.
If the answer is of interest to a wider audience, I will email the answer to all.
Important: Questions on labs should be sent to Dr. Geoff Pignotta

Labs: There is a lab component to this course.
Please direct your questions to Dr. Geoff Pignotta:
geoffpignotta@cunet.carleton.ca

Brightspace: All course material will be provided through Brightspace.
This includes lecture notes, quizzes, announcements (announcements will also be emailed) and marks. For problems with Brightspace, go to:
<https://carleton.ca/brightspace/>

Textbook

Please note that most geological concepts are described in introductory manuals on geology. Before the lectures, I will send you some references, often short on-line videos, that will introduce the topics of the lectures.

2. Kehew, Alan E. 2006. Geology for Engineers & Environmental Scientists. 3rd Edition. Prentice Hall.

Note: the textbook is out-of-print and consequently, not mandatory. The textbook is available on reserve in the library.

Exams: Exams are closed books.
The exam cover materials presented during the lectures.
The mid-term covers Lectures 1 to 6

and
the final exam only covers Lectures 7 to 13.
Both exams are MANDATORY and will be proctored.

Quizzes: Quizzes will include general questions on the lecture of the week. They give students a good opportunity to keep on top of the material before the exams.

Labs: Please see the lab schedule for a list of labs.
A passing grade in the lab work must be achieved to pass the course.
TA's will maintain lab attendance and grades will be posted on Brightspace.
Switching lab times is not permitted without permission of the lab coordinator.

Material Covered			% of final grade
Lecture Exams	Midterm Exam	Lectures 1-6	25%
	Final Exam	Lectures 7-13	25%
Lecture Quizzes		Up to 10 quizzes	10%
Lab Work	Lab Exercises		40%
			100%

Lecture Schedule:

Date	Lecture	Topic	Chapters in Kehew
Jan. 12	1	Introduction & Geologic Time	1, 2
Jan. 19	2	Minerals & Igneous Rocks	3, 4
Jan. 26	3	Sedimentary and Metamorphic Rocks	5, 6
Feb. 2	4	Plate Tectonics	2
Feb. 9	5	Earthquakes and Engineering Seismology	8
Feb. 16	6	Structures (faults, folds)	8
Feb. 23		No class Winter Break (Feb 20-24)	
March 2 14:35-16:05	Midterm	Mid-term (on Lectures 1-6)	
16:10-17:25	7	Soils	10
March 9	8	Volcanic hazards	4
March 16	9	Rock Mechanics and Mass Movement	8
Mar. 23	10	Weathering, Erosion and Groundwater	7, 13

Mar. 30	11	Rivers, Oceans and Glacial Processes	9, 11
April 6	12	Earth Resources and Geophysical Methods	14, 15, 16
April 13	13	Geomagnetic Hazards, Geological Impacts of Climate Change and Review	---

Lab Sections:

Section	Day and Time	Location
L8	Tuesday 11:35 – 14:25	HP 2110
L3	Tuesday 14:35 – 17:25	
L6	Tuesday 18:05 – 20:55	
L1	Wednesday 08:35 – 11:25	
L9	Wednesday 11:35 – 14:25	
L2	Wednesday 18:05 – 20:55	
L7	Thursday 18:05 – 20:55	
L12	Friday 11:35 – 14:25	

Winter 2023 Laboratories

Week	Date	Topic	Lab Weight
1	01/09-01/13	No Labs	
2	01/16-01/20	Physical Mineralogy	1.25
3	01/23-01/27	Igneous Rocks	1.25
4	01/30-02/27	Sedimentary Rocks	1.25
5	02/06-02/10	Metamorphic Rocks	1.25
6	02/13-02/17	LAB PRACTICAL EXAM	15
7	02/20-02/24	Winter Break	
8	02/27-03/03	Topographic Maps and Aerial Imagery	3.33
9	03/06-03/10	Geologic Structures and Geologic Maps	3.33
10	03/13-03/17	Plate Tectonics	3.33
11	03/20-03/24	Earthquakes and Earthquake Hazards	3.33
12	03/27-04/31	Soils and Soil Mechanics	3.33
13	04/03-04/07	Water Resources	3.33

Academic Integrity:

It is your responsibility to review Carleton's policy on Academic Integrity -Section 14 of the Calendar.

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/academicintegrity/>

In particular, please consider:

12. Tests and Examinations

The University is committed to ensuring fairness and consistency in the completion of examinations. As part of this commitment, students are required to follow proper examinations procedures. A student who commits a violation of this Policy on an examination, test, or takehome examination, or obtains or produces an answer or unfair advantage are subject to sanction under this Policy.

This includes but is not limited to:

- bringing to the examination/test room any unauthorized material;
- writing an examination or part of it, by consulting any person or materials outside the confines of the examination room without permission to do so;
- intentionally leaving answer papers exposed to view;
- attempting to read other students' examination papers;
- speaking to another student (even if the subject matter is irrelevant to the test);
- disrupting or delaying a test or examination;
- failing to comply with the instruction of a University official administering an examination.

A violation of this Policy may also occur by breaching one of the Rules and Procedures of Examinations.

Plagiarism:

Plagiarism is presenting, whether intentionally or not, the ideas, expression of ideas, or work of others as one's own. Plagiarism includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research

results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, and material on the internet. This includes copying of material from websites or other publications that is incorporated into assignments, reports, or other submissions for grading. Borrowing someone else's answers, unauthorized possession of tests or answers to tests, or possession of material designed in answering exam questions, are all subject to university policy regarding instructional offences. Academic dishonesty, in whatever form, is destructive to the values of the university, and risks harming the university's reputation as place of learning and innovation. Furthermore, it is unfair and discouraging to those students who pursue their studies honestly. Additional details regarding the Carleton University Academic Integrity policy: <https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy-2021.pdf>

Academic Integrity: Minimum penalties for offences starting 6 January 2020

First offence, first-year students (< 4.0 cr): Final grade reduction of one full grade (e.g., A- becomes a B-, if that results in an F, so be it)

First offence (everyone else): F in the course

Second offence: One-year suspension from program

Third offence: Expulsion from the University

Note: these are minimum penalties. More-severe penalties will be applied in cases of egregious offences (e.g., a first-year student accessing Brightspace from their phone during an exam will be given an F in the course; bribing a faculty member for a better grade would be grounds for suspension, etc.)

Course Outline (Syllabus) Information on Academic Accommodations

Student Accommodation Processes:

Pregnancy obligation:

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: <http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

Religious obligation:

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known

to exist. For more details, visit the Equity Services website: <http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

Academic Accommodations for Students with Disabilities:

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at <https://carleton.ca/pmc/> or 613-520-6608 or pmc@carleton.ca for a formal evaluation. Contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). *After requesting accommodation from PMC, contact and/or meet with your instructor directly as soon as possible to ensure accommodation arrangements are made.*

Survivors of Sexual Violence:

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <http://carleton.ca/sexual-violence-support>

Accommodation for Student Activities:

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: <https://students.carleton.ca/course-outline/>

Missed exam

Students who missed an exam for a medical or other important reason must contact Maurice Lamontagne as soon as possible (within 2 days). Arrangements will be made for the student to do the exam at a later date.