ERTH 2105: Geodynamics

Geodynamics is a subfield of Earth Sciences that studies the processes occurring within the Earth. It explains how the stress and strain in the Earth's crust create various geological systems, including mineral deposits and tectonic features such as mountains, faults, and seafloor spreading. Additionally, it examines the interaction between the mantle, core, and lithosphere, considering forces such as mechanical stress, gravity, and heat flow. These forces are challenging to evaluate as they control the movement of magma and tectonic plates, the circulation of hydrothermal fluids, and the formation of fault systems. Consequently, geodynamic models incorporate concepts from fields like structural geology, plate tectonics, geophysics, and mathematics to reflect these phenomena accurately.

In this course, we focus on the fundamental theoretical and analytical methods that are used to interpret geodynamic processes and tectonic plate movements. The main objective is to cover the fundamental principles of common methods in geodynamics and to prepare students for practical cases in their future career. Additionally, laboratory assignments are designed to strengthen students' understanding of geodynamic fundamentals.

Prerequisites:

- ERTH 1006 or permission from the Department.

Course Information:

- Instructor: Dr. Fateme Hormozzade Ghalati (Fatemehormozzadeghal@cunet.carleton.ca)
- Two hours per week, Wednesdays, 9:35-11:25, HP 3120
- September 4 to December 6 (Fall break on the week of October 21)
- Office hours: If you have any questions, please email me and we can set up a time to meet
- There will not be any assessments due during the Fall break

Laboratory Information:

- Teaching Assistant: TBA (will be posted on Brightspace)
- Three hours of laboratory per week (Labs begin after the second lecture)
- TA office hours: By appointment
- For lab sessions, students must print the assignments posted on Brightspace or bring a laptop with wireless internet access

Course Topics (Tentative Order):

- Introduction to Geodynamics
- Stress
- Strain
- Plate Tectonics
- Faults and Fault Systems
- Lithosphere Flexure
- Seismology and the Internal Structure of the Earth
- Gravity and Isostasy
- Geomagnetic Field and Paleomagnetism
- Heat Flow and Thermal Parameters

Learning Outcomes:

By the end of the course, students will be able to evaluate and interpret geodynamic models including:

- Apply the concepts of stress and strain to understand lithospheric deformation, folding, and faulting
- Explain the physical and mechanical properties of the Earth's interior using seismological data
- Analyze the present and past kinematics of tectonic plates using paleomagnetic data and seafloor spreading models
- Investigate the regional variations in the Earth's gravitational field to explain isostasy and lithosphere flexure
- Relate the Earth's magnetic field to its internal structure and geodynamic processes
- Analyze fault systems, classify different fault types, and explain their role in tectonic activity
- Construct models of heat flow within the Earth and explain the thermal structure of the lithosphere and mantle

Course Requirements:

- Final Exam: The final exam must be passed in order to pass the course.
- Lab Component: The lab component of the course must be passed to pass the course. Failure to pass the labs results in ineligibility to sit for the final exam.
- Lab Deadlines: Labs must be handed in on time. Late submissions will be accepted only with valid reasons (illness or emergencies) and by consultation with the TAs and instructor.

- Attendance: It is the student's responsibility to attend all lectures and labs and come prepared. Mandatory reading assignments will be given throughout the course. It is required that you advise of absences due to illness or emergencies. Please make sure to use Academic Consideration for Coursework Form - Registrar's Office (carleton.ca)
- Brightspace: Students are expected to regularly check Brightspace for announcements, assignments, and course materials. Lab exercises will also be posted on Brightspace.

Course Textbook:

- Fowler**,** C.M.R., 2005, The Solid Earth, 2nd edn. Cambridge Univ. Press. (optional)
- Lecture files and notes will be posted on Brightspace every week.

Grading Scheme:

• Laboratory participation and assignments	25 %
• Midterm test (Date/location TBA on Brightspace)	25 %
• Final exam (Date/location TBA on Brightspace)	50 %

University Policies:

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52
F = <50			
WDN = Withdrawn from the course			DEF = Deferred

Land Acknowledgement:

Here at Carleton University, it is important that we acknowledge that the land on which we gather is the traditional and unceded territory of the Algonquin nation.

Assistance for Students:

Career Services: https://carleton.ca/career/

Writing Services: https://carleton.ca/csas/support/

Peer Assisted Study Sessions (PASS): https://carleton.ca/csas/group-support/pass/

Math Tutorial Centre: https://carleton.ca/math/math-tutorial-centre/

Science Student Success Centre: https://sssc.carleton.ca/

Appropriate Use of Technology in the Classroom:

- Cell phones must be always turned OFF
- Laptops and tablets are to be used only to look and annotate the lecture notes

Academic Integrity:

It is your responsibility to review Carleton's policy on Academic Integrity:

- Academic-Integrity-Policy-2021.pdf (carleton.ca)

Particularly, please consider the following:

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 take-home examination, or who obtains or produces an answer or unfair advantage are subject to sanction under the Policy. This includes but is not limited to:

- Bringing to the examination/test any unauthorized material
- consulting any person or materials, including online materials, without permission to do so during an examination
- Intentionally leaving answer papers exposed to view
- attempting to read other students' examination papers
- speaking to another student where prohibited
- 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 or course-specific instructions (please refer to doc...)

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, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- Any submission prepared in whole or in part, by someone else
- Using ideas or direct, verbatim quotations, paraphrased material, algorithms
- Formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment
- Using another's data or research findings without appropriate acknowledgement
- Submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own
- Failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotations marks

In the Faculty of Science, sanctions for misconduct under the Academic Integrity Policy of Carleton University will normally be applied as follows:

- A first offence will result in a grade of zero on the work(s) associated with the misconduct, and a deduction of up to three (3) grade points from the final course grade (e.g. a grade of B could be reduced to a C).
- Any subsequent offences will result in increasingly severe sanctions ranging from:

    A final grade of F in the course.
    Suspension from studies for up to three (3) semesters.
    Expulsion of enrollment from the University.

Note: These sanctions are provided here as guidelines only; more severe sanctions may be applied as appropriate (e.g., in the case of cheating on an examination). Additional details regarding the Academic Integrity: Academic Integrity | Faculty of Science (carleton.ca)

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 is 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: Sexual Violence Prevention & Survivor Support | Equity and Inclusive Communities (carleton.ca)

Information on Academic Accommodations:

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

- Deferred/missed term work for short-term accommodation (5 days or less): the course outline must stipulate the process by which the student may gain informal accommodation for short term incapacitation (i.e., via submitting a self-declaration form, a written email to the professor, TA, etc.), and the appropriate accommodation (e.g., extension, alternate assignment, etc.).

  If you require supporting documentation for short-term considerations, you may only request the Academic Consideration for Coursework form. You may not request medical notes or documentation.

- Deferred/missed term work for longer term incapacitation (5 days or longer): it would be helpful to include a statement to indicate to the student to email you (the instructor) for guidance. The student will need to go to the Registrar's Office for support, but it is important that the instructor is apprised of the long-term accommodation needs. For example:
  If you require accommodations for this course that are longer than the 5-day (short-term) period, please email me to discuss how/whether accommodation needs could be met for this course.

Students with Disabilities:

Identify your needs for disability-related academic accommodation to the Paul Menton Centre for Students with Disabilities (PMC), supported by relevant documentation from a registered health care professional, by booking an intake appointment with a PMC Coordinator. Documentation forms are available for download on the PMC website at Paul Menton Centre - Carleton University.

Pregnancy:

- For exams Early in the term, identify your needs for exam accommodations to an Equity Advisor in Equity and Inclusive Communities and fill out an Exam Accommodation Form.

- For in-class accommodations ONLY If you anticipate you will only require in-class accommodations, discuss them directly with your course instructor. If your request is denied, contact Equity and Inclusive Communities for assistance.
- For any additional needs related to family status please contact Equity and Inclusive Communities.

Parental Leave:

Either parent may request up to three terms of leave, which must be completed within 12 months of the date of birth or custody or request for leave for health related family responsibilities.

Students with Religious Obligations:

- As soon as you receive your course syllabus, identify any potential conflicts between your religious obligations and course requirements.
- Make a formal written request to your instructor indicating the nature of the religious obligation and suggest possible alternative dates and/or means of satisfying the academic requirements. NOTE: Such request should be made during the first two weeks of the term, or as soon as possible after a need for accommodation is known to exist, but in no case later than the second last week of classes for that term. Even if you are unclear as to the exact date of the obligation (e.g., when waiting for a moon sighting) you are still expected to notify your instructor of the potential conflict and explore accommodation options.
- If your request for accommodation is denied you may contact Equity and Inclusive Communities and request assistance in an informal review of the decision

Contact Information:

Department of Equity and Inclusive Communities, 613-520-5622, 3800 Carleton Technology & Training Centre
Email: equity@carleton.ca Website: Equity and Inclusive Communities | Carleton University

Paul Menton Centre for Students with Disabilities:

500 University Centre, 613-520-6608, TTY: 613-520-3937
Email: pmc@carleton.ca Website: Paul Menton Centre - Carleton University

Additional Details: 19-195 Equity Student Guide to Academic Accomodation.indd (carleton.ca)

Equity Concerns: Students (EDI Resources) Page Option 2 | Faculty of Public and Global Affairs (carleton.ca)