



**COURSE OUTLINE**

1. **Course:** GOPH 351, Introduction to Geophysics - Fall 2019

Lecture 01: MWF 13:00 - 13:50 in EDC 057

Instructor	Email	Phone	Office	Hours
Dr Jan Dettmer	jan.dettmer@ucalgary.ca	403 220-4606	ES 212	W 11 am - noon

This course provides an introduction to important geophysical concepts and methods that are used to study the Earth and solve various geoscientific problems. Topics include tectonics on a sphere, isostasy, gravity and magnetism, heat flow, radioactivity and geochronology, earthquake seismology, reflection and refraction seismology.

**Course Site:**

D2L: GOPH 351 L01-(Fall 2019)-Introduction to Geophysics

**Note:** Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

**Prerequisite(s):**

Geology 201 and 202; Mathematics 267 or 277; Physics 211 or 221, and 223.

**Antirequisite(s):**

Credit for Geophysics 351 and 359 will not be allowed.

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %
Laboratory Assignments (8)	30
Term tests (2)	30
Final Examination	35
TopHat Questions	5

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
<b>Minimum % Required</b>	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	56%	53 %	50 %

Scores within 0.5% of the upper boundary of a percent range (e.g., 79.5%) may or may not be rounded up at the discretion of the instructor (a decision will be made based on the student's performance in the course). For percent grades on a boundary, the higher grade will be chosen (e.g., 75% is a B, not a B-).

This course has a registrar scheduled final exam.

This course will employ TopHat during lectures to conduct quizzes. There will be a minimum of 50 in-class questions. Each correctly answered question counts for 0.1 percent and results are added up to a maximum of 5

percent.

#### 4. **Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section M.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize themselves with these regulations. See also [Section E.3](#) of the University Calendar.

#### 5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

#### 6. **Course Materials:**

Required Textbook(s):

Fowler, C.M.R., *The Solid Earth: An Introduction to Global Geophysics, 2nd edition* Cambridge.

Other materials: posted on D2L.

#### 7. **Examination Policy:**

1-sided, letter-size, handwritten equation sheet is allowed. The content of the sheet is up to the students.

Students should also read the Calendar, [Section G](#), on Examinations.

#### 8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

#### 9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

#### 10. **Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

#### 11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **10 business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar

b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

#### 12. **Other Important Information For Students:**

a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).

- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](tel:403-220-2208).
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).
- Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Sr. Instructor of the Department of Geoscience, Dr. Rudi Meyer by email [rmeyer@ucalgary.ca](mailto:rmeyer@ucalgary.ca) or phone 403-210-7848. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca). SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). [Student Ombudsman](#), Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca).
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected

by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

Tentative Lecture schedule:

1. Introduction: The physical basis for geophysical properties. How Earth's interior is inferred from geophysical methods. Forward and inverse geophysical modelling.
2. Tectonics on a sphere: Rotation vectors and rotation poles. Past and present-day plate motions. Plate boundaries and their evolution over time.
3. Gravity and geodesy: Newton's Universal Law of gravitation. Gravitational potential and Earth's gravitational field. Geodesy and lithospheric flexure.
4. Geomagnetism: Origin of Earth's magnetic field. Magnetic potential and dipole field strength. Rock magnetism. Paleomagnetism and past plate motions.
5. Applications of potential-field data: Instruments for measuring gravitational and magnetic field strength. Basic data processing. Forward modeling and inversion.
6. Radioactivity and geochronology: Nuclear decay and radioactivity. General theory for radiometric age dating. Overview of geochronology methods. Age of the Earth.
7. Terrestrial heat flow: Conductive heat flow. Calculation of simple geotherms. Global heat flow, continents versus oceans.
8. Applications of heat flow measurements: The adiabat and melting in the mantle. Metamorphism: geotherms in the continental crust.
9. Deep interior of the Earth: Internal structure of the Earth. Convection in the mantle. Earth's core.
10. Seismic waves: Linear elasticity. Stress and strain. Basic principles of seismology: waves, rays, Snell's law, Huygens' principle. Reflection and refraction. Surface and body waves.
11. Earthquakes and global seismology. Anderson's theory of faulting. Earthquake magnitude scales. Probing Earth's deep interior using seismic waves.
12. Review

Tentative Laboratory Schedule:

1. Basic mathematics exercises: Error propagation, least-squares method, plate motions.
2. Gravity and Isostasy
3. Gravity and lithospheric flexure
4. Geochronology and heat flow
5. Elastic Earth properties and earthquake location
6. Earthquake seismology
7. Reflection seismology, migration
8. Refraction seismology

**Course Outcomes:**

- To explain the physical basis for geophysical properties (heat generation and transfer, seismic waves, magnetism, gravity).
- To interpret physical properties of the Earth from geophysical measurements (e.g., thickness of the crust and lithosphere, age of the Earth and its components, earthquake hazard, potential drilling locations from seismic data)
- To apply geophysical inference to deduce basic physical properties and structure of the Earth.
- To calculate relative motions of plates on a sphere, steady-state geotherms, satellite orbital parameters, earthquake magnitude and location, overburden thickness from seismic refraction observations.
- To perform error analysis for basic geophysical calculations such as geochronological age estimation and seismic velocity determination.
- To communicate important geophysical concepts in written and oral form.

Department Approval:

Electronically Approved

Date: 2019-08-26 12:07