



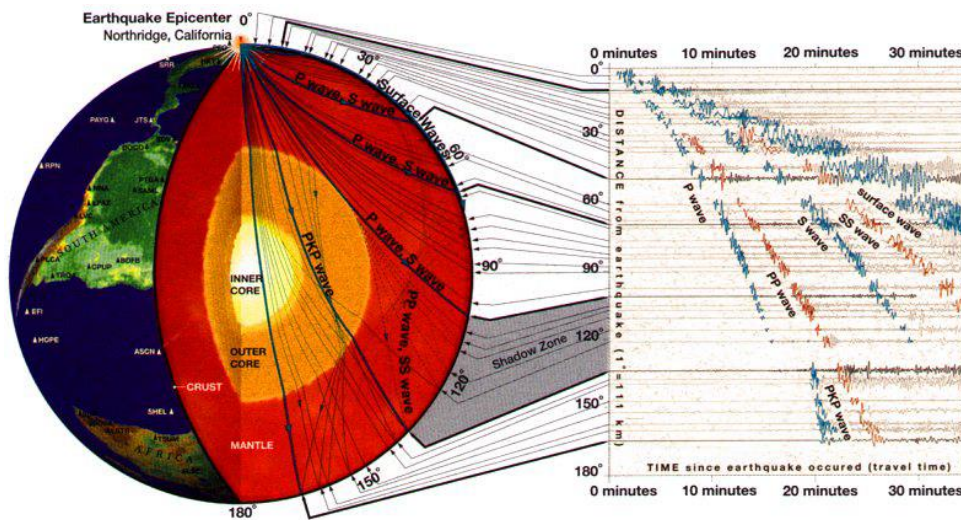
COURSE OUTLINE

EOS/PHYS 210 Introductory Geophysics

Lectures: 9:30-10:20 Tuesdays, Wednesdays & Fridays

Tutorials: 2:30-4:20 Wednesdays

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̓SÁNEĆ Peoples whose historical relationships with the land continue to this day.



Example of geophysical remote sensing: Earthquake generated seismic waves penetrate the earth and return to the surface, providing information on interior structure and processes (IRIS Educational and Public Outreach Program).

COURSE DESCRIPTION

An introduction to seismology, gravity, geomagnetism, paleomagnetism, and heat flow, and how they contribute to our understanding of whole Earth structure and plate tectonics.

PREREQUISITES

MATH 101 (Calculus II)

One of PHYS 110 (Introductory Physics) or Physics 120 (Physics)

CONTACT INFORMATION

Instructor: Stan Dosso

Email: sdosso@uvic.ca (Please include "210" in the subject line)

Office: BWC A331

Office Hours: 3:00-4:00 Thursdays—In-person and on zoom

<https://uvic.zoom.us/j/4863207576?omn=84732694333>

Also welcome in-person or zoom at other times (please check via email)

TA: Brandyn Butchard bbutchard88@gmail.com

COURSE MATERIALS

Text (Optional): *Whole Earth Geophysics: An Introductory Textbook for Geologists and Geophysicists* by R. J. Lille (Selected topics, Chapters 1-10). At UVic Bookstore for ~\$250 new, \$190 used. Copy on reserve at library.

Tutorial Manual: *Introduction to Coding in MATLAB* by S. Dosso (Updated weekly on Brightspace).

Brightspace will be used for posting course information, tutorial material, and class notes/figures, and for posting and submitting assignments (see below).

Classes are in-person and will not be recorded. Course notes will be developed on the board in class. Notes will also be posted on Brightspace at the end of each week as an additional resource—*Please attend classes and take notes!*

LEARNING OUTCOMES

Upon completion of this course, students should be able to:

- Demonstrate broad understanding of how fundamental concepts of physics are applied to study the Earth, including seismic waves, gravity, heat flow, and magnetism.
- Explain the theory of plate tectonics and its foundation in geophysical observations.
- Derive mathematical equations describing geophysical processes and, conversely, translate equations into physical concepts, explaining the processes represented mathematically.
- Apply basic physics and mathematics to estimate quantitative models of Earth structure and processes from geophysical data.
- Apply basic knowledge of computer coding to solve geophysical problems and plot results.

TUTORIALS

Tutorials will provide an introduction to the fundamentals of computer coding based on MATLAB, as required for some assignments. Tutorials follow a manual written for the course, with appropriate sections posted on Brightspace in advance, as needed. Tutorials will present material at a beginner level and are optional: students with a background in coding may not find them necessary. Not all tutorials cover new coding material, some provide an opportunity to review course material before exams or help with assignments—see the Weekly Course Calendar below. Students should bring their own computers to tutorials (let me know if this presents a problem for you). Before the first tutorial, students should install MATLAB on their computer by visiting <https://www.mathworks.com/academia/tah-portal/university-of-victoria-31110150.html>, clicking the *sign in to get started* button, and following the directions (MATLAB is free for UVic students).

EVALUATION

Weekly assignments (~9)	20%
Midterm Exam 1 (Oct. 10)	20%
Midterm Exam 2 (Nov. 7)	20%
Final Exam (within Dec. 6-20)	40%

Notes:

- Assignments will be posted most weeks at Brightspace and must be submitted to Brightspace as a PDF file (photos of handwritten work converted to PDF are acceptable, provided they are fully legible). Assignments are due at the start of Friday classes, as assigned. See late policy, below.
- Some Assignments include questions requiring computer coding in MATLAB which will be covered in the tutorials. You are expected to write, use, and submit your own code.

- Assignments are an important component of mastering course material—you are welcome/encouraged to see me at Office Hours (or otherwise) for help as needed.
- Midterms will be 50-minute, in-class exams. The Final Exam will be cumulative but weighted more heavily to material covered after Midterm 2. The Final will include roughly twice as much material as a midterm but 3 hours will be allocated to relieve time pressure.
- Practice exams will be provided prior to exams as a study aid. Mathematical formulas needed for exams will be provided on the exam—no need to memorize or prepare your own formula sheet.
- Passing the course is based on your cumulative grade as specified above.

COURSE POLICIES

Late/Missed Assignments or Exams

- Late assignments are normally penalized 10%/day to a maximum of 5 days after which a zero mark is assigned.
- Late assignments may be accepted without penalty given reasonable justification (e.g., illness, travel, unusually heavy workload)—please contact me in advance of the due date with requests.
- If you miss or know you will miss a Midterm or the Final Exam, let me know as soon as possible. For justified reasons (e.g., illness) the value of a missed Midterm will be added to the Final Exam. If two Midterms are missed, a make-up exam must be scheduled. If the Final Exam is missed, a make-up exam must be scheduled.
- The Final Exam and at least one Midterm are essential components that must be completed to pass the course.

Academic Integrity

UVic's Policy on Academic Integrity is found at web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html. It is every student's responsibility to be aware of this policy, including policies on cheating, plagiarism, unauthorized use of an editor, multiple submission, and aiding others to cheat. If you have any questions or doubts, please talk to me. For more information, see uvic.ca/learningandteaching/cac.

Use of AI

You are not permitted to use any form of generative AI tools, such as ChatGPT, for content generation in this course. As the University of Victoria states in its Academic Integrity Policy "*Academic integrity requires commitment to the values of honesty, trust, fairness, respect, and responsibility.*" You are expected to comply with this course syllabus and to enhance your academic experience by refraining from use of generative AI.

UVIC CALENDAR

UVic Important Dates: uvic.ca/calendar/dates/

Last day to add courses: September 19

Last day to drop a course without penalty of failure: October 31

Final exam period: December 6-20

COURSE CALENDAR AND OUTLINE

The following is an approximate calendar and outline for EOS/PHYS 210. The (optional) text can provide a useful reference for most of the material; however, assignments and exams are based only on the course notes and tutorials. Note that several topics will be covered that are not in the text, and a number of topics in the text will not be included in the course.

Week	Lecture Dates	Lecture Material (Approximate)	Tutorials
1	Sept. 3, 5	Introduction: What is Geophysics?	No Tutorial
2	Sept. 9, 10, 12	Introduction / Seismic Waves	Sept. 10 Coding: Introduction
3	Sept. 16, 17, 19	Seismic Waves	Sept. 17 Coding: Arrays
4	Sept. 23, 24, 26	Seismic Waves / Seismic Refraction	Sept. 24 Coding: Scripts
5	Sept. 30, Oct. 1, 3	Seismic Refraction	Oct. 1 Coding: Plotting
6	Oct. 7, 8, 10	Seismic Reflection / Midterm 1	Oct. 8 Midterm Review
7	Oct. 14, 15, 17	Reflection / Earthquake Seismology	Oct. 15 Coding: Loops
8	Oct. 21, 22, 24	Earthquake Seismology	Oct. 22 Coding: Conditionals
9	Oct. 28, 29, 31	Earthquake Seismology / Gravity	Oct. 29 Coding: Input/Output
10	Nov. 4, 5, 7	Gravity /Midterm 2	Nov. 5 Midterm Review
11	Nov. 14	Reading Break / Gravity	No Tutorial
12	Nov. 18, 19, 21	Heat Flow	Nov. 19 Assignment Help
13	Nov. 25, 26, 28	Geomagnetism	Nov. 26 Course Review
14	Dec. 2, 3	Geomagnetism	No Tutorial

1. Introduction (Text pages 14-44; Approximately 3 classes)

- What is geophysics?
- Basic geophysical approaches, forward and inverse problems, resolution and penetration
- Basic earth structure (compositional: crust/mantle/core; rheological: lithosphere/asthenosphere)
- Basic plate tectonics (plate types, margins, and movements; tectonic cycle)
- Juan de Fuca Plate system, Cascadia Subduction Zone

2. Seismic Waves in the Earth (Text pages 45-59; Approximately 6 classes)

- Elastic properties of solids (stress and strain, Hooke's law, bulk modulus, shear modulus, Young's modulus, Poisson's ratio)
- Body waves (compressional and shear waves)
- Surface waves (Rayleigh and Love waves; wave dispersion)
- Wave propagation losses (geometric spreading, absorption)
- Waves at boundaries: reflection, refraction, conversion; Snell's law

3. Seismic Refraction (Text pages 59-96; Approximately 4 classes)

- Critical refraction
- Slope-intercept inversion method (single and multiple layers)
- Low-velocity zones
- Crustal structure and thickness

4. Seismic Reflection (Text pages 100-111; Approximately 4 classes)

- Reflection time-distance curves
- Dix inversion (single and multiple layers)

- Imaging the subsurface: Seismic data processing (velocity analysis, normal moveout, stacking, migration)
- Seismic images of geologic/tectonic features

5. Earthquake Seismology (Text pages 185-205; Approximately 6 classes)

- Earthquake mechanisms and locations; earthquakes at tectonic margins
- Locating earthquakes (uniform-velocity method; time-distance curves)
- Earthquake intensity and magnitude scales (Mercalli intensity; Richter magnitude, surface-wave magnitude, body-wave magnitude, moment magnitude)
- Earthquake energy release; Gutenberg-Richter relationship
- Earthquake seismograms and whole Earth structure

6. Gravity (Text chapter 8; Approximately 5 classes)

- Gravity on the earth's surface
- Measuring gravity
- Gravity corrections and anomalies (latitude adjustment, elevation adjustment, excess mass adjustment, Bouguer gravity anomaly)
- Gravity and geologic/tectonic features

7. Heat Flow (Text chapter 10; Approximately 3 classes)

- Heat sources within the earth
- Heat transfer (conduction, convection, radiation)
- Heat-flow equation
- Heat flow measurements
- Radial temperature variation
- Oceanic heat flow and evolution of oceanic crust
- Heat as a driving force for plate tectonics

8. Geomagnetism (Text chapter 9; Approximately 5 classes)

- Source of Earth's magnetic field (geodynamo, Faraday disc analogue)
- Properties of Earth's magnetic field, axial dipole model
- Magnetic induction and susceptibility
- Magnetization and magnetic anomalies
- Paleomagnetism, geomagnetic polarity time scale
- Oceanic magnetic anomalies and plate kinematics

CHANGES DUE TO UNFORESEEN CIRCUMSTANCES

The schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances. In the event of significant changes, a revised outline will be posted/circulated.

COURSE FEEDBACK

I value your feedback on this course. Towards the end of term, as in all courses at UVic, you will have the opportunity to complete an anonymous **Course Evaluation Survey (CES)** regarding your learning experience. The survey is important for providing feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. The survey is accessed online and can be done on your laptop, tablet, or mobile device. I will remind you and provide you with more detailed information nearer the time, but please be thinking about this important activity during the course.

APPENDICES

SCHOOL OF EARTH AND OCEAN SCIENCES INFORMATION

- SEOS Website: uvic.ca/seos
- SEOS Office: seos@uvic.ca
- SEOS Director: Dr. Jay Cullen, seosdirector@uvic.ca
- SEOS Mental Health & Wellness Contact: Dr. Andy Fraass, andyfraass@uvic.ca
- SEOS Undergraduate Advisor: Dr. Jon Husson, seosadvisor@uvic.ca
- SEOS Graduate Advisor: Dr. Roberta Hamme, seosgradadvisor@uvic.ca
- Ocean Science Mentor: Dr. Jody Klymak, seosoceansci@uvic.ca
- Climate Science Advisor: Dr. Colin Goldblatt, climateadvising@uvic.ca

UNIVERSITY STATEMENTS & POLICIES

- Academic Calendar: [Information for All Students](#)
- [Creating a respectful, inclusive, and productive learning environment](#)
- [Accommodation of Religious Observance](#)
- [Accommodation and Access for Students with Disabilities](#)
- [Student Conduct](#)
- [Non-academic Student Misconduct](#)
- [Accessibility](#)
- [Diversity / EDI](#)
- [Equity statement](#)
- [Sexualized Violence Prevention and Response](#)
- [Discrimination and Harassment Policy](#)

UVIC GRADING SYSTEM

As per the Academic Calendar:

Grade	Grade point value	Grade scale	Description
A+ A A-	9 8 7	90-100% 85-89% 80-84%	Exceptional, outstanding and excellent performance. Normally achieved by a minority of students. These grades indicate a student who is self-initiating, exceeds expectation and has an insightful grasp of the subject matter.
B+ B B-	6 5 4	77-79% 73-76% 70-72%	Very good, good and solid performance. Normally achieved by the largest number of students. These grades indicate a good grasp of the subject matter or excellent grasp in one area balanced with satisfactory grasp in the other area.
C+ C	3 2	65-69% 60-64%	Satisfactory, or minimally satisfactory. These grades indicate a satisfactory performance and knowledge of the subject matter.
D	1	50-59%	Marginal Performance. A student receiving this grade demonstrated a superficial grasp of the subject matter.
F	0	0-49%	Unsatisfactory performance. Wrote final examination and completed course requirements; no supplemental.
N	0	0-49%	Did not write examination or complete course requirements by the end of term or session; no supplemental.

STUDENT RESOURCES

POSITIVITY AND SAFETY

The University of Victoria is committed to promoting, providing, and protecting a positive and safe learning and working environment for all its members ([Student Groups & Resources](#)).

ACADEMIC RESOURCES

UVic Library offers many services and resources for undergraduate and graduate students (uvic.ca/students/academics/library-services).

Learning Resources: UVic Learn Anywhere is the primary learning resource for students that offers many learning workshops and resources to help students with academics and learning strategies (onlineacademiccommunity.uvic.ca/LearnAnywhere/learning-strategies).

Centre for Academic Communication offers online and in-person one-on-one tutorials, workshops, and more (uvic.ca/learningandteaching/cac).

Math & Stats Assistance Centre offers drop-in, face-to-face tutoring and a friendly, collaborative study space for 100- and 200-level math and stats courses (uvic.ca/science/math-statistics/current-students/undergraduate/msac).

MENTAL HEALTH & WELLNESS

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

SEOS Mental Health & Wellness Contact: Dr. Andy Fraass is a SEOS faculty member who can act as a sympathetic ear and (more importantly) provide guidance about how to access the multitude of University support services, and which are useful in different circumstances. Andy can be found by dropping by his office or lab (BWC A431, B409). He is also available via email for questions or to arrange a time to have a chat (andyfraass@uvic.ca).

Student Wellness Centre: Our team of practitioners offers a variety of services to support students' mental, physical, and spiritual health (uvic.ca/student-wellness).

Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students (uvic.ca/services/counselling/).

University Health Services (UHS) provides a full-service primary health clinic for students and coordinates healthy student and campus initiatives (uvic.ca/services/health/).

ACCESSIBILITY

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a documented disability or health consideration that may require accommodations, please feel free to approach me and/or the **Centre for Accessible Learning (CAL)** as soon as possible. CAL staff are available by appointment

to assess specific needs, provide referrals and arrange appropriate accommodations. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course (uvic.ca/services/cal/).

ADVISING

For academic advising-related questions, students in the School of Earth and Ocean Sciences are encouraged to meet with the SEOS Undergraduate Advisor (seosadvisor@uvic.ca) as well as an academic advisor in the Academic Advising Centre early in their studies to help map out a plan to declare a major and complete university program requirements.

Academic Advising Centre: Academic advice and support is currently available by phone, email and virtual or in-person appointments (uvic.ca/services/advising).

Ombudsperson: The ombuds office is an independent, impartial, and confidential resource for undergraduate and graduate students and other members of the University of Victoria community. The ombudsperson helps resolve student problems or disputes fairly (uvicombudsperson.ca).

ACADEMIC CONCESSION

Undergraduate Academic Concessions: You can request an academic concession if your course requirements are affected by unexpected and unavoidable circumstances or conflicting responsibilities. Concession requests can be for an in-course extension, deferral, withdrawal under extenuating circumstances, or an aegrotat. Please speak to an advisor at the Academic Advising Centre if you have questions on how requesting a concession will affect your academic program (uvic.ca/students/academics/academic-concessions-accommodations).

EQUITY AND HUMAN RIGHTS AT UVIC

EQHR (uvic.ca/equity) is a resource for students, staff, and faculty who have experienced sexualized violence, discrimination, and/or harassment and are looking for informal and/or formal resolution options as well as advice, coaching, and/or education. We are available for confidential consultations so that you can ask questions and learn your options. Contact EQHR by email at eqhr01@uvic.ca or in-person (Sedgewick C115).

Sexualized Violence Resource Office: If you have been directly or indirectly impacted by sexualized violence, reach out to the SVRO for information, advice, resolution options (restorative and disciplinary) as well as support options and referrals. The SVRO is both survivor-centred and trauma-informed in their approach. You can reach us by phone at [250-721-8021](tel:250-721-8021) or by email at eqhr01@uvic.ca to book either an in-person (Sedgewick C119) or online appointment (uvic.ca/svp).

RESOURCES FOR INTERNATIONAL STUDENTS

International Centre for Students is the primary office supporting international students on campus at the university-wide level (uvic.ca/international-experiences).

UVic Global Community Initiative provides various supportive programming, including a Mentorship Program and Conversation Partner Program (uvic.ca/international-experiences/get-involved/uvic-global-community).

RESOURCES FOR INDIGENOUS STUDENTS

Indigenous Student Support: UVic offers holistic services to Indigenous students throughout their academic journey (uvic.ca/students/info-for/indigenous-students).

Elders in Residence: The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty, and administration in Indigenous ways of knowing and being (uvic.ca/services/indigenous/students/programming/elders).