

COURSE OUTLINE

University of Victoria
Dept of Physics and Astronomy
School of Earth and Ocean Sciences

PHYS/EOS 427 Geophysics

Spring 2017 (A01)

Class Schedule:

Tuesday, Wednesday, Friday, 8:30–9:20, Clearihue C115

Instructors:

Jeremy Gosselin (jeremyg@uvic.ca) and Stan Dosso (sdosso@uvic.ca). Office Hours: Wednesdays 1:30–3:00 in BWC A403 (or make an appointment via email).

Course Description:

Principles of seismology, gravity, heat flow, geochronology, and how they contribute to our understanding of Earth structure and plate tectonics.

Prerequisites:

Prerequisites: PHYS 220 or 321A; PHYS 326;

Pre- or co-requisites: One of MATH 301, 330B, 438; MATH 326 or 346

Text (Optional):

C. M. R. Fowler, 2005. *The Solid Earth: An Introduction to Global Geophysics*, Second Edition, Cambridge University Press. Selected material from Chapters 4–7 and Appendices 2–4. An excellent and highly-recommended text, but class notes and handouts will be sufficient for the course. A copy of the text is on 2-hour reserve in the Library.

Course Website:

The course website is on the UVic CourseSpaces system. Go to coursespaces.uvic.ca and enter your UVic NetLink ID and password. You should find a list of your courses including PHYS 427 or EOS 427. Assignments and handouts will be available as pdf files. Class notes will be posted at the end of the week they are given in class as an additional resource—*please attend classes and take notes or this policy may change*.

Grading:

| | |
|------------------------------------|--------|
| Assignments (approximately weekly) | — 20 % |
| Midterm Exam (February 22) | — 20 % |
| Final Exam (3 hours) | — 60 % |

Notes:

- Assignments are due in class one week after they are given out in class.
- All requests for Deferred Status for the final exam must be made at Records Services on a Request for Academic Concession form.
- Marks will be posted at the course website using student numbers. Any student not wanting his/her marks posted must inform the Instructor at the beginning of the course.
- Useful dates: January 17 is the last day to withdraw from a course with 100% return on fees. January 20 is the last day to add a class. February 28 is the last day for withdrawal without penalty of failure. February 13-17 is Reading Break. Last class: April 4. Final exams: April 7–25.
- Any instances of cheating or plagiarism will be acted upon. Students are advised to refer to the UVic policy on Academic Integrity found at web.uvic.ca/calendar/FACS/UnIn/UARe/PoAcI.html

Grade Equivalences at UVic:

| Percentage | Letter Grade | Num. Grade | Standing |
|------------|--------------|------------|-----------|
| 90–100 | A+ | 9 | 1st Class |
| 85–89 | A | 8 | |
| 80–84 | A– | 7 | |
| 77–79 | B+ | 6 | 2nd Class |
| 73–76 | B | 5 | |
| 70–72 | B– | 4 | |
| 65–69 | C+ | 3 | Pass |
| 60–64 | C | 2 | |
| 50–59 | D | 1 | |
| < 50 | F | 0 | Fail |

Course Outline:

The following is an approximate outline for PHYS/EOS 427. The text will provide a useful reference for most material. However, several topics will be covered that are not in the text, and many topics in the text will not be included in the course.

1. Seismic (Elastic) Wave Theory (Chapter 4 and Appendix 2)

- Stress and strain matrices; dilation and rotation
- 3-D Hooke's Law for isotropic solids
- Lamé parameters and elastic moduli
- Vector displacement equation
- Compressional (P) and shear (S) wave equations
- Displacement potentials and P and S particle motion
- Snell's law for wave reflection, refraction, conversion
- Zoeppritz equations: elastic reflection and transmission coefficients
- Energy partitioning (energy coefficients)
- Surface-wave solution to wave equation: Rayleigh waves
- Rayleigh wave particle motion, velocity, dispersion relation
- S_H resonance: Love waves; dispersion relation
- Dispersion inversion

2. Earthquake Seismology (Chapter 4 and Appendices 3 & 4)

- Overview of the Tectonics and Seismicity of Cascadia
- Global seismic paths
- Spherical ray tracing
- Inversion of earthquake time-distance curves for Earth radial velocity structure (Herglotz-Wiechert inversion)
- Density, elastic moduli from seismic velocity (Adams-Williamson equation)
- Seismic tomography

3. Gravity (Chapter 5)

- Gravitational Potential
- Shape of the Earth
- Isostasy: Airy and Pratt hypotheses
- Free-air and Bouger gravity anomalies
- Compensated and uncompensated anomalies
- Poisson equation

4. **Heat Flow** (Chapter 7)

- Heat conduction and convection
- Heat flow (conduction-diffusion/advection) equation
- Geotherms
- Heat flow, isostasy and ocean depth

5. **Geochronology** (Chapter 6)

- Theory of radioactive decay
- Decay series
- Age of the Earth