

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
SCHOOL OF ENGINEERING
DEPARTMENT OF STRUCTURAL AND GEOTECHNICAL ENGINEERING
ABET COURSE SYLLABI

ICE2630 GENERAL GEOPHYSICS

Credits and contact hours: 10 UC credits / 10 hours (3 h. Lectures; 1,5 h. Assistantship;1,5 h. Labs; 4 h. Independent learning experiences)

Instructor's name: Gonzalo Yañez

Course coordinator's name Gonzalo Yañez

Textbook: Lowrie, W. (2002) Fundamentals of geophysics. Cambridge University Press

Course Catalog Description: This course presents an introduction to the physics of the Earth's interior, using as a theoretical basis the Plate Tectonics Theory. Describing first the associated first order observations, and later on, going into deep detail on the physics of the associated processes and the inferences derived from this knowledge. Finally in the course, a brief description is presented in terms of how the geophysics is used as an indirect tool for engineering and geological exploration problems.

Prerequisite Courses: None

Co-requisite Courses: FIS1533 Electricity and Magnetism

Status in the Curriculum: Required

Course Learning Outcomes:

1. Recognize first order observations associated to the action of plate tectonics.
2. Identify the cause-effect relationships that conditions and had conditioned the Earth geological evolution since its birth.
3. Explain the theoretical concepts that allows the quantification of the physical processes associated to the plate tectonics and the earth interior dynamics.
4. Recognize the first order physical factors of the earth interiors that conditions natural risks and resources.
5. Infer the potentiality of the geophysical observations as an indirect tool for the comprehension of the earth interior, from sub-metric scale to tens or hundreds kilometers depth.
6. Present an example of the scientific method through the description of the Plate Tectonic Theory and their implications.

Relation of Course to ABET Criteria:

- a. Knowledge of mathematics, science and engineering
- e. Identify, formulate, and solve engineering problems
- h. Broad education necessary for global, economic, environmental and societal context

k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Introduction to plate tectonics.
 - 1.1. Course description. Applications of geophysics and Earth Sciences.
 - 1.2. Theoretical framework. Global tectonics. Seismicity, magmatism and deformation.
 - 1.3. Active, passive, and transform margins. Plate rotation.
2. Gravity and earth shape: Gravitation, Earth Rotation, shape and gravity, gravity anomalies, concepts of flexure and isostasy.
3. Seismology and earth interior.
 - 3.1. Notions of elasticity theory.
 - 3.2. Seismic waves, earthquake seismology. Seismic wave propagation, applied seismology.
 - 3.3. Earth internal structure.
4. Geomagnetism and paleomagnetism.
 - 4.1. Magnetism physics, Geomagnetism.
 - 4.2. Rock Magnetism, Paleomagnetism.
 - 4.3. Magnetic Anomalies of oceanic and continental crust.
 - 4.4. Magnetic exploration.
5. Heat and geo-electricity.
 - 5.1. Heat at the earth interior, heat flow and heat release mechanism in the earth: mid-oceanic ridges, volcanoes, and super plumes.
 - 5.2. Geo-electricity.
6. Geodynamics.
 - 6.1. Basics of fluid mechanics.
 - 6.2. Heat-fluid coupling: simple models of convection.
 - 6.3. Rheology and deformation, plate dynamics.
 - 6.4. Mantle convection styles and mass balance
 - 6.5. Driving forces that conditions plate tectonics: ridge push and slab pull concepts.
7. Geological resources.
 - 7.1. Geophysics as an exploration tool.
 - 7.2. Mining, oil, geothermal, and groundwater exploration
8. Seismic Hazard.
 - 8.1. Seismic recurrence and segmentation. Gutenberg-Richter law.
 - 8.2. Basics of probabilistic analysis for the estimate of seismic risk and tsunamis physics.
9. Andean Geophysics.
 - 9.1. Crustal seismicity, gravity, isostasy and flexure.
 - 9.2. Magnetic provinces of Chile and its relationship with magmatic arcs.
 - 9.3. Characterization of crustal damage zone.