

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

ICE2025 GEOCHEMISTRY AND PETROGENESIS

Credits and contact hours:	10 UC credits / 10 hours (3 h. Lectures; 3 h Assitanship; 4 h Independent Learning Experiences)
Instructor's name:	To be defined.
Course coordinator's name	To be defined
Textbook:	<ul style="list-style-type: none">- McSween, H.; Richardson, S.; Uhle, M. (2003) Geochemistry: pathways and processes. Columbia University press, New York.- Gill, R. (1995) Chemical fundamentals of geology. 2nd ed. Chapman and Hall, London.
Course Catalog Description:	<p>This course is planned to be taught since 2015. In it, students will discuss the quantitative distribution of chemical elements in minerals and rocks. They will study the behavior and migration of chemical elements in nature, according to the thermodynamic and physicochemical conditions of the different geological environments. All the previous will allow the students to understand the procedures and required conditions for the creation or modification of the different natural materials (minerals and rocks) on time and space. They will apply thermodynamic basic principles for the equilibrium of mineral phases, geochemistry of mayor and traces elements with petrogenetic purposes, and isotopic geochemistry for the dating of minerals and rocks.</p>
Prerequisite Courses:	ICE2028 Mineralogy and petrology and ICE2633 Structural geology and tectonics
Co-requisite Courses:	None
Status in the Curriculum:	Required
Course Learning Outcomes:	<ol style="list-style-type: none">1. Analyzing the quantitative distribution of chemical elements on minerals and rocks.2. Identifying and evaluating the thermodynamic and physicochemical variables that command the behavior and migration of chemical elements in nature, according to the different environments.3. Applying the geochemical methods on geochronology, magmatic systems, hydrothermal systems, superficial processes, geochemical prospection and environmental geochemistry.

- Relation of Course to ABET Criteria:**
- a. Knowledge of mathematics, science and engineering
 - d. Multidisciplinary teams
 - h. Broad education necessary for global, economic, environmental and societal context
 - j. Knowledge of contemporary issues

- Topics covered:**
- 1. Introduction: the chemical elements.
 - 1.1. The periodic table of the elements.
 - 1.2. Properties of the elements.
 - 1.3. Distribution of the elements on Earth.
 - 1.4. Ionic radius and electronegativity.
 - 1.5. Isotopes.
 - 1.6. Families of chemical elements.
 - 2. Mineral-Chemical Crystallography.
 - 2.1. Thermodynamic Principles.
 - 2.2. Compatible and incompatible element.
 - 2.3. Partition Coefficient.
 - 3. Analytical Methods used in Geology.
 - 3.1. General description.
 - 3.2. "Wet" methods.
 - 3.3. "Dry" methods.
 - 3.4. Advantages and disadvantages of every method.
 - 4. Geochemistry of magmatic systems.
 - 4.1. Igneous processes.
 - 4.2. Mineralogical composition.
 - 4.3. Phases diagram.
 - 4.4. Fractional crystallization, in equilibrium and eutectic.
 - 4.5. Magmatic differentiation.
 - 4.6. Igneous rock classification.
 - 5. Isotopic Geochemistry.
 - 5.1. Radiogenic isotopes: radioactive lapse, medium age, fractioning, magma differentiation, dating and magma origin.
 - 5.2. Geochronology: the system Rb-Sr, Sm-Nd, Re-Os, etc., System K-Ar y Ar-Ar, System U-Pb, Cosmogenic dating.
 - 5.3. Stable isotopes: oxygen and deuterium isotopes, C isotopes, S isotopes.
 - 5.4. Concepts and diagrams Eh-pH
 - 5.5. Mineral stability.
 - 5.6. Geochemistry of water.
 - 6. Applied geochemistry.
 - 6.1. Geochemical prospection.
 - 6.2. Environmental geochemistry.