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

ICE3653 ROCK MECHANICS

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

Instructor's name: Esteban Hormazábal

Course coordinator's name Esteban Hormazábal

Textbook: González de Vallejo, L., Ferrer, M., Ortuño, L., Oteo, C., (2002) Ingeniería Geológica. Pearson Educación, Madrid.

Course Catalog Description: Build mathematical models for the ground conditions in order to analyze the stability of rock excavations, identify the restrictions to the model and design rock excavations, including open pit excavations and underground excavations.

Prerequisite Courses: ICE2604 Fundamentals of geotechnical engineering

Co-requisite Courses: None

Status in the Curriculum: Required

Course Learning Outcomes:

1. Describe the most important laboratory tests to evaluate the engineering properties of intact rocks.
2. Compute the mechanical properties of rock samples tested in the laboratory.
3. Indicate typical values of the mechanical properties of intact rocks.
4. Define and describe the relevant characteristics of rock discontinuities.
5. Explain how the discontinuities influence the behavior of rock masses.
6. Apply common methods to evaluate the shear strength of rock discontinuities.
7. Determine the orientation of critical joint systems.
8. Classify rock masses according to 3 of the most common methods.
9. Evaluate the quality of field data and signal possible pit holes of information.
10. Solve stability problems on rock wedges, including open pit excavations and underground excavations.
11. Solve stability problems of mining slopes.
12. Compute or estimate the stresses around underground excavations.
13. Identify the most probable failure mechanism on an underground excavation.
14. Estimate de ground displacements induced by an underground excavation.

15. Evaluate the results of the instrumentation of excavations.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
e. Identify, formulate, and solve engineering problems
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. DESCRIBING ROCK MASSES.
   - 1.1. Methods used to describe rock masses. (RMR, Q, GSI indexes).
   - 1.2. Procedures for ground recognition
   - 1.3. Types of geological structures.
   - 1.4. Procedures to present geological and structural information.
   - 1.5. Stereographic projection (hemispheric). Use of software DIPS.
2. ROCK RESISTANCE AND DEFORMABILITY.
   - 2.1. Basic concepts and definitions
   - 2.2. Laboratory tests:
     - 2.2.1. Behavior of isotropic rock samples.
     - 2.2.2. Criteria for isotropic rock failure.
     - 2.2.3. Anisotropic rock resistance.
     - 2.2.4. Shear resistance of discontinuities (sliding).
     - 2.2.5. Models to estimate resistance and deformation of discontinuities on ground.
     - 2.2.6. Resistance of rock masses.
3. SLOPE STABILITY.
   - 3.1. Failure mechanisms.
   - 3.2. Analysis of wedge static stability.
   - 3.3. Analysis of stability for open pit excavations.
   - 3.4. Estimation of support by anchors.
   - 3.5. Use of software SWEDGE.
4. UNDERGROUND EXCAVATIONS.
   - 4.1. Excavation methods and reinforcement systems.
   - 4.2. Failure modes.
   - 4.3. Use of the Theory of Elasticity to estimate stress distribution and deformations on underground excavations.
   - 4.4. Failure controlled by structures and Block Theory. Analysis using stereographic net and software UNWEDGE.
   - 4.5. Failure controlled by stress state. Analysis using analytical methods and software PHASE2.