PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF MINING ENGINEERING
ABET COURSE SYLLABI

# IMM2023 MINERAL PROCESSING

**Credits and contact hours:** 10 UC credits / 10 hours (3 h. Lectures and 7 h. Independent learning experiences)

**Instructor's name:** Álvaro Videla

**Course coordinator's name** Álvaro Videla

**Textbook:**

- "Principles of Mineral Processing", Ed.: Maurice C. Fuerstaneau and Kenneth N. Han, 2003, Society for Mining, Metallurgy and Exploration (SME).
- "Modelling & Simulation of Mineral Processing Systems", R.P. King, 2001, Buttherworth-Heinemann.
- "Mineral Processing Plant Design, Practice and Control", Ed: Andrew Mular, Doug Halbe and Derek Barrat, 2002, Society for Mining, Metallurgy and Exploration (SME).

**Course Catalog Description:** This course is an introduction to mineral processing topics. It covers aspects of particle liberation and comminution, solid-solid separation of fine particles and solid-liquid separation, among others. Critical variables affecting the concentration process are identified as well as performance indicators. To this end, physical and chemical aspects controlling interactions of each process unit are studied and such understanding of the process is deepens in order to analyze practical design and operation aspects in the context of copper and gold extraction plants

**Prerequisite Courses:** IMM2003: Mining geology or ICE2623: Introduction to physical geology

**Co-requisite Courses:** None

**Status in the Curriculum:** Required

**Course Learning Outcomes:**

1. Describe and analyze the processes of crushing, grinding, classification, flotation, water recovery and mineral transport.
2. Identify the advantages and disadvantages of the available technologies for the various stages involved in the mineral concentration.
3. Understand the effects of sampling error, the relationship between laboratory testing and results scaling.
4. Recognize and select commonly used mathematical models to interpret the operation of most relevant processes identifying the controlling parameters and the important variables.
5. Dimension the main industrial equipment for a mineral concentration

plant performing mass balances and recovery estimates.

**Relation of Course to ABET Criteria:**

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
d. Multidisciplinary teams
e. Identify, formulate, and solve engineering problems
h. Broad education necessary for global, economic, environmental and societal context
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice.

**Topics covered:**

1. Introduction: Context, main flow process in plants of copper, gold and other metals.
2. Mineral managing: metallurgical accounting and process control. Sampling methods, online analysis, concentration, weighing, mass balance methods. Particle size analysis, grids, particle size distribution curves and chemical analysis methods. Liberation and separation efficiency concepts.
3. Comminution Theories: Fundaments of comminution. Fracture mechanics. Energy Consumption.
4. Ore crushing: Primary crushers. Secondary crushers. Tertiary crushers. Crushers sizing. Testing and Scale-up.
5. Grinding: SAG mills, ball mills, rod mills, HPGR, others. Conventional mill assays. Bond's method and others. Mill Design elements. Design of crushing and grinding circuits. Testing and Scale-up.
6. Classification: Screens and Hydrociclones. Selection criteria for classification equipment and classification circuit design. Testing and Scale-up.
7. Gravity concentration and Separation in dense media. Equipment's efficiency calculation.
8. Flotation: Principles of flotation. Collectors, regulators, frothers, activators, depressants, others. Equipment used in flotation. Flotation circuits design. Typical circuits used in copper minerals' flotation. Testing and Scale-up.
9. Tailings disposal and treatment.
10. Introduction to mill plant modelling, design and simulation processes. Water and Solid Mass Balance in Circuits. Population Balance Modelling for Grinding. Flotation models. Mill Plant Survey, data reconciliation and optimization analysis.