

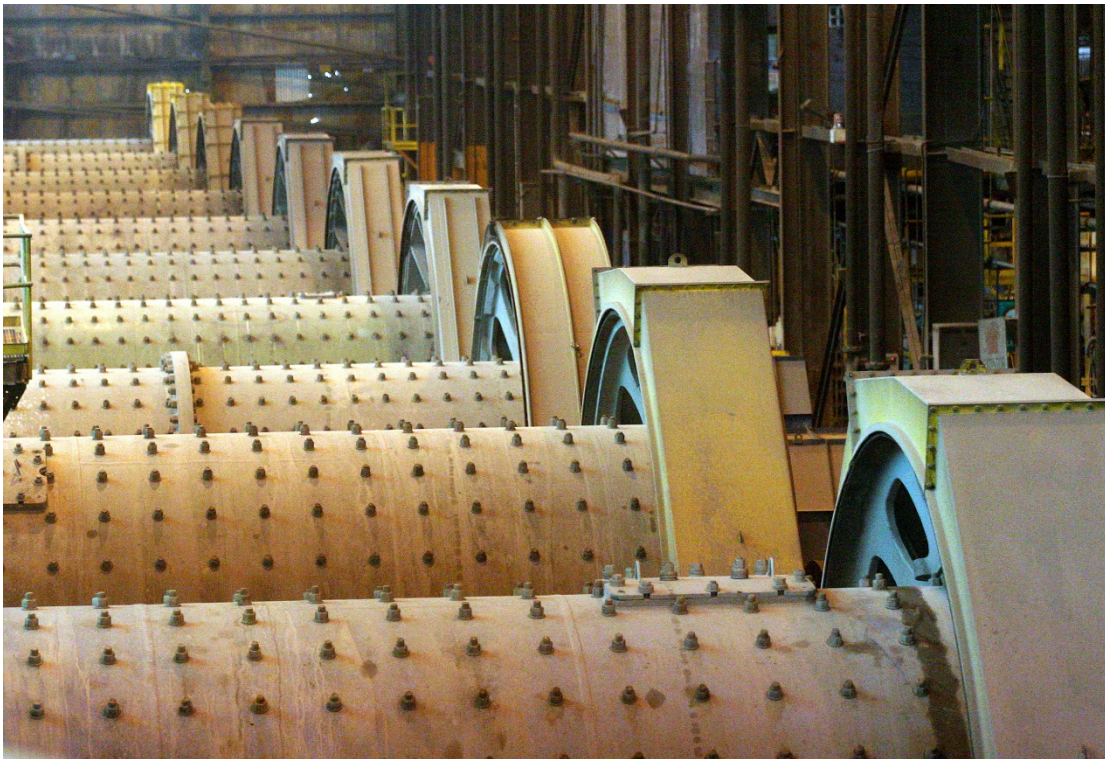


fcfm

Ingeniería de Minas
FACULTAD DE CIENCIAS
FÍSICAS Y MATEMÁTICAS
UNIVERSIDAD DE CHILE

Diploma

Geo – Mining - Metallurgy



Version: October 2016

Director: Prof. Javier Vallejos

Presentation

The Department of Mining Engineering offers the **Diploma in Geo-Mining-Metallurgy**. The program is oriented to **engineers, geologists and others related engineering professionals**. This program provides students with a broad-based fundamental knowledge of new techniques in geo-mining-metallurgical evaluation and optimization of the mineral processing stage. It is also designed to **strengthen students' communication, problem-solving, critical thinking, and teamwork skills**.



Objectives

The Diploma aims to give students comprehensive training in mining, emphasizing the focus from Geo - Mining - Metallurgic to design and mine planning problems in the field of projects and the mining business.

At the end of the program the student will have acquired the **tools to add value** to the entire chain of the **mining business**.

Location: Department of Mining Engineering, Faculty of Physical and Mathematical Sciences - Universidad de Chile, Av. Tupper 2069, Santiago.

Time: Monday to Friday from 9:00 to 13:00 and from 14:00 to 18:00.

Contact: Ingrid Thiele - Verónica Möller

diploma@minas.uchile.cl

Phone number: (+562) 2978 4503

Note 1: *The Department of Mining Engineering has the right to suspend the Diploma if the number of students is not enough to ensure minimum administrative conditions and the quality of the program.*

Note 2: *If one of the lecturers or professors needs to be replaced, the program has the commitment to find a new one with similar background.*

Course description

The Diploma considers 7 modules of one-week length (280 hours) covering different areas of Geo – Mining -Metallurgy and personal work (80 hours) between modules. Here you can find a brief description or contents of the courses of the Diploma. Courses consider among their activities exercises with the supervision of assistants, and an exam.

1. Ore Body Models – Sampling

Ore body models: Concepts and Definitions, the mining business, hydro-thermal mechanism, fluids source, and alterations. Sulphide stability, transport and precipitation of metals. Ore body models (Porphyry copper). **Sampling:** The course aims to present the theoretical and practical concepts of sampling and quality control applied to geological exploration and grade control in mining (blasting holes and short-term planning). Sampling error types and fundamental error.

2. Resource Evaluation – Statistical Data Analysis

Geo-statistical resources evaluation, variograms, resources estimation, kriging, cross validation and jack-knife, international codes for resources and reserves report and classification, introduction to geo-statistical simulation. **Statistical data analysis. Data regression and modelling.**

3. Mine Design

Introduction to rock mechanics, open pit mine design, mine to mill, drilling and blasting fundamental, blasting fragmentation, load and haul equipment for open pit mining fundamentals, fleet calculation, selective and massive underground design methods, underground/ open pit transition. Stopes and pillars, induced stress on excavations, empirical design methods.

4. Minerallurgical Processes Fundamentals

Mineralogical Operations: Particles characterization, pulp characterization. - Solid-liquid interactions, flows, density, viscosity, Reynolds number, and sedimentation. Milling and comminution. Surface physical chemistry, flotation electrochemistry, flotation probability, reagents. **Comminution operations:** Equipment and operation description – crushing, vibrating screens, milling, SAG milling, HPGR, cyclones, vertical mills. Work index and milling efficiency. Input-output ratios, energy and Steel consumption. **Concentration of minerals:** Equipment and operation description. Agitated cells, N cells Banks, columnar cells, flotation steps, collective and selective flotation. **Mine to Mill:** Fragmentation – Blasting, crushing and milling as an integrated process, lithological classes and other rock characteristics.

5. Metallurgical Processes Fundamentals

Extractive metallurgy. Integral geology-mining-metallurgy outlook, processes and technologies for oxides, mixed and sulfides. Market and production centers, historical outline for processes and metallurgical technologies. **Metallurgical operations:** roasting, melting, conversion, fire refining, electro refining, agglomeration, ore and concentrate heap leaching (chemical and bacterial),

dumps, scopes and reactors, solvent extraction and electro winning. **Treatment and stabilization** of arsenic, dust treatment, slag, complex materials and gases, sulfuric acid, neutralization of acidic liquid waste and water. Solid waste disposal. **Recycling of metals.**

6. Introduction to Mine Planning – Mining Projects Management and Evaluation

Introduction to Mine Planning: Economic definition of mineral. Economic evaluation of a block. Cut-off grade. **Economic Envelope:** Standard planning methodology: Economic envelope. Design. Scheduling. Production plan. Economic evaluation. **Production and economic value:** Mine design. Nested pits. Pushbacks selection. Phases selection. Economic Evaluation. **Mining Projects Management and Evaluation:** Costs, deadlines, quality, risks, human resources, communications, acquisitions, stakeholders.

7. Sustainability Project / Case Study

Environmental Ethics and Sustainable Development. Definition of the environment. Environmental components air, water, soil, flora, and fauna. Pollution and environmental effects. Environmental impacts and its characterization. Environmental impacts of mining and metallurgical processes

Each program's module will be evaluated through tests/readings/presentations/reports and/or a final exam. The minimum passing grade is 4,0 on a scale from 1,0 to 7,0.

Professors and Lecturers

- **Prof. Brian Townley**, Geologist, Ph.D., Queen's University
- **Dr. Eduardo Magri**, Mining Engineer, Ph.D., University of the Witwatersrand
- **Dr. Antoni Magri**, Agro Engineer, Ph.D. Cornell University
- **Prof. Xavier Emery**, Mathematical Engineer, Ph.D., Ecole des Mines de Paris
- **Prof. Raúl Castro**, Mining Engineer, Ph.D., The University of Queensland
- **Dr. Nelson Morales**, Mathematical Engineer, Ph.D., Université de Nice Sophia-Antipolis
- **Prof. Javier Vallejos**, Civil Engineer, Ph.D., Queen's University
- **Alejandro Cáceres**, Geologist, Master Universidad de Chile
- **Ing. Gustavo Reyes**, Mining Engineer, Universidad de Chile
- **Ing. Magín Torres**, Mining Engineer, M.Sc., Universidad de Chile
- **Prof. Gonzalo Montes**, Chemical Engineer, Ph.D., Institut National PolyTechnique de Lorraine
- **Prof. Leandro Voisin**, Mining Engineer, Ph.D., Tohoku University
- **Dr. Jesús Casas**, Chemical Engineer, Ph.D., Universidad de Chile
- **Prof. Christian Ihle**, Civil Engineer, Ph.D., Universidad de Chile
- **Dr. Jacques Wiertz**, Geologist, Ph.D., Universidad de Lieja

Application and Admission Requirements

Candidates have to the following requirements, may apply to the Diploma:

- Hold a bachelor degree in a discipline related to the program. They may also apply those who hold a professional degree which level, content and duration of studies correspond to an equivalent to the degree of Bachelor of the University of Chile.
- Curriculum Vitae
- Application Form
- Sponsor letter (company's financing) and payment order

Each application will be resolved by the Academic Director of the Program, who will decide the acceptance or decline of the admission, based on the information presented.

Interested people registering the Diploma must apply to the program by sending the documents describe above to: diploma@minas.uchile.cl

Fees

US\$ 10,000 per student

- All candidates must pay an enrollment fee of US\$ 500 -CLP \$ 350,000 when accepted.
- Students that are sponsored by their companies must send a letter of support and a payment order.

Certification

After requirements are fulfilled, the student will receive a **Diploma in Geo-Mining-Metallurgy**, issued by the Faculty of Physical and Mathematical Sciences of the University of Chile.