NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

METALLURGICAL ENGINEERING PROGRAM

ME421 – MINERALS AND MATERIALS PROCESSING II

I. GENERAL INFORMATION

CODE	**:**	ME421 Minerals and Materials Processing II
SEMESTER	**:**	7
CREDITS	**:**	4
HOURS PER WEEK	**:**	6 (Theory–Practice–Laboratory)
PREREQUISITES	**:**	ME321 Minerals and Materials Processing I
CONDITION	**:**	Mandatory
DEPARTMENT	**:**	Metallurgical Engineering

II. COURSE DESCRIPTION

Continuing with the study of minerals processing methods presented in courses ME321Minerals and Materials Processing I and ME421 Minerals and Materials Processing II (leaching and flotation), this course prepares students in the understanding and analysis of gravimetric, magnetic and electrostatic separation methods applied to solid-solid separation of special and high-value minerals. Students are also prepared to determine the costs of metallurgical operations and processes, market analysis of minerals concentrates, as well the economic valuation of metallurgical projects considering Net Present Value, Cash Flow and Internal Return Rate criteria.

III. COURSE OUTCOMES

At the end of the course, students:

1. Elaborate flowcharts of mineral processing based on gravity, magnetic and electrostatic separation processes.
2. Explain the operation and select the equipment, devices and instruments used in gravimetric, magnetic and electrostatic separation processes.
3. Analyze and economically justify the operations of solid-solid separation processes.
4. Integrate magnetic or electrostatic separation processes in the general flowchart of mineral concentration processes.
5. Determine the technical and economic feasibility of metallurgical projects.

IV. LEARNING UNITS

1. INTRODUCTION

Mineral processing / Objectives of the solid-solid separation / Leaching / Flotation / Economic analysis fundamentals / Concentrates and minerals valuation / Influence of metallurgic operations, and local and global market conditions on concentrates and minerals prices.

2. METALLURGICAL OPERATIONS COSTS

Costs of solid-solid separation metallurgical operations / Investment, fixed and variable costs, working capital / Operation costs: production, sales, administrative, financial.

3. ECONOMIC EVALUATION

Time value of money / Economic evaluation / Cash flow / Evaluation criteria: Net Present Value and Internal Rate of Return.

4. SOLIDS MOVEMENT

Movement of solids on fluids / General characteristics of gravimetric separation / Concentration criteria / Gravitational concentration separators / Classification of gravitational methods: Separation in dense media, separation in horizontal, vertical and centrifugal currents / Case study: Flow chart of metallurgical plant of MINSUR Mining Co.

5. GRAVIMETRY

Gold gravimetry / Centrifugal concentrators / Industrial flowcharts of gold recovery by gravimetry / Gravimetrically recoverable gold. Case study.

6. MAGNETIC SEPARATION

Solid-solid separation using electromagnetism / General characteristics of magnetic separation / Methods and required equipment / Industrial flowcharts / Case study.

V. PRACTICAL WORK

Session 1: Mineral sample characterization: Physical, chemical, sieving, mineralogical and metallurgical characterization.
Session 2: Gravimetry in tables of tungsten minerals.
Session 3: Magnetic separation of hubnerite. High intensity magnetic separation.
Session 4: Technical report. Design of magnetic and gravimetric separation plants.

VI. METHODOLOGY

The course takes place in theory, practice and laboratory sessions. In theory, faculty presents and analyze concepts and methods. In practice sessions diverse problems related to separation processes, as well as the technical and economic feasibility of metallurgical projects are analyzed. In laboratory sessions, students perform tests and verify expected outcomes and results. After each laboratory experience, students submit a report describing procedures and summarizing results and conclusions. At the end of the course, students present and defend a separation process design project. Student active participation is promoted.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (2*EP + 3*EF + PP1 + 2*PP2) / 8

EP: Mid-term Exam EF: Final Exam
PP1: Average of Practical Work PP2: Average of Practical and Laboratory Work

VIII. BIBLIOGRAPHY

1. A. GUPTA, D.S. Yan.
   Mineral Processing Design and Operations: An Introduction, Elsevier, 2006.
2. FUERSTENEAU, M.C; HAN, K.N.
   Principles of Mineral Processing, SME, Colorado, USA, 2003.