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

The course prepares students in the understanding and application of mineral separation and classifications processes. Flotation processes are analyzed including their mechanisms and kinetics, as well as flotation reactants and cells. Solid-separation separation processes such as sedimentation, filtration, flocculation are analyzed and compared. The design, installation, operation and risks of tailing dams are analyzed for different situations. Laboratory experiences are carried to verify the characteristics and efficiency of different separation processes.

III. COURSE OUTCOMES

At the end of the course, students:

1. Understand the probabilistic characteristics of mineral classification processes implemented through sieving, mechanic or hydric methods.
2. Analyze the influence of surface physical chemical properties on mineral flotation behavior, considering the interfaces derived form matter states.
3. Interpret the formation of double layers and understand their importance in mineral flotation processes.
4. Select reactants and equipment of flotation processes, and test and analyze mineral concentration levels.
5. Implement solid-solid separation processes using thickener agents and filter
6. Select proper dams for storage the tailing of concentration processes, considering environmental issues, and applying proper norms and regulations.

IV. LEARNING UNITS

1. MINERAL CLASSIFICATION

Sieving / Classification / Partition curve / Adjusted partition curve / Classification efficiency / Rake classifier / Helical hydro-cyclone classifier. Particle separation / Parameters and variables / Design.

2. SURFACE PHYSICAL-CHEMISTRY

Introduction to surface physical-chemistry / Surface tension / Adsorption / Contact angle / Interface.

3. **INTERFACE ELECTRICAL PHENOMENA**
   Structure of double electric layer / Surface electric potential / Zeta Potential / Zero charge potential.

4. **MINERALS FLOTATION**
   Minerals flotation / Variables of flotation process / Flotation mechanism / Flotation circuits / Flotation kinetics / Flotation reactants / Flotation cells: mechanic, pneumatic.

5. **SOLID-SOLID SEPARATION**
   Sedimentation / Sedimentation velocity / Flocculation / Thickening / Thickening agents / Filtration / Filtration media / Filtration velocity / Filtration equipment.

6. **TAILING DAM**
   Downstream tailing dam / Central line tailing dam / Design and installation considerations / Operation / Risks of tailing dams / Environmental issues.

V. LABORATORY AND PRACTICAL WORK

Session 1: Particles classification in hydro-cyclone.
Session 2: Mineral flotation.
Session 3: Flotation kinetics.
Session 4: Particle sedimentation.

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 minerals flotation, solid-solid separation and tailing dams are analyzed and solved. 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. Student active participation is promoted.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PL) / 3

EP: Mid-term Exam EF: Final Exam
PL: Average of Practical and experimental Work

VIII. BIBLIOGRAPHY

1. WILLIS, B.A.
   Technologies of Mineral Processing, Elsevier, 2006.
2. FUERSTENEAU, M.C; HAN, K.N.
   Principles of Mineral Processing, SME, Colorado, USA, 2003.