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

METALLURGICAL ENGINEERING PROGRAM

ME525 – PLANT DESIGN

I. GENERAL INFORMATION

CODE	**:**	ME-525 Plant Design
SEMESTER	**:**	10
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (Theory–Practice)
PREREQUISITES	**:**	ME-421 Minerals and Materials Processing II ME-427 Extractive Processes II
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course helps the graduate of the Metallurgical Engineering Program to have clear concepts on Engineering projects involving mineral processing and existing methods for designing plants and dimensioning of circuits and metallurgical equipment for mineral concentration and Hydrometallurgy by solving typical problems of the industry involved in plant design.

III. COURSE OUTCOMES

1. Organize the information for proper analysis and interpretation and calculates and interprets the main parameters of plant design.
2. Explain and determines the likelihood of further studies to achieve the design parameters.
3. Develop and determines the appropriate type of mineral processing for which the plant will be designed according to the type of project being developed.
4. Calculate and develop parameters and operation schemes, balances, dimensioning of equipment, and others to design the plant.
5. Prepares various documents as deliverables that contain all the evolution of the design to economic evaluation through the sizing and selection of equipment.
6. Hold up with correct idiomatic in verbal and written ways of the design done.

IV. LEARNING UNITS

1. INTRODUCTION / 04 hours

Engineering projects / Flow sheets / Balance in mineral processing / Deliverables of plant design.

2. PROCESSING SCHEMES AND FLOWSHEET DEVELOPMENT / 04 hours

Processing schemes of Polymetallic minerals: Cu-Pb-Zn, Cu-Zn and Pb-Zn / Processing schemes for non-sulphuretted ores / Sampling / Mineral characterization / Research Lab methods / Process definition.

3. CRUSHING / 06 hours

Review of the theory of crushing / Crushing and plant design / Testing for the design in crushing / Crushing schemes / Equipment sizing.

4. **MILLING / 06 hours**

   Theory of milling in the plant design / Testing for milling design / Milling schemes / Equipment sizing.

5. **FLOTATION AND SEPARATION OF SOLID-LIQUID / 04 hours**

   Sulphide flotation / Flotation of mineral that contained gold / Test for the design in flotation / Flotation schemes / Dimensioning of flotation equipment / Thickening and filtration theories / Solid-liquid separation in concentrates / Solid-liquid separation in tailings / Testing for the design in solid-liquid separation / Separation schemes / Sizing equipment in solid-liquid separation.

6. **AUXILIARY OPERATIONS AND ECONOMIC EVALUATION / 04 hours**

   Need for auxiliary operations / Auxiliary operations / Testing for design / Dimensioning auxiliary operations equipment / Capex / Opex / Estimated costs / Economic evaluation.

V. LABORATORY AND PRACTICAL EXPERIENCES

Practice 1: About project concepts and existing types.

Practice 2: Metal, mass and water balances.

Practice 3: Crushing.

Practice 4: Milling.

Practice 5: Flotation.

Practice 6: Auxiliary operations and economic evaluation.

VI. METHODOLOGY

The course takes place in theory and practice sessions. Additionally, lessons and practices of software that helps to plant design are provided. In the theory sessions, the instructor presents the concepts and applications. In the practical sessions, various problems are solved and their solutions are analyzed. Specialized simulation software is used to solve problems and analyze their solutions. In all sessions, the active participation the student is encouraged.

VII. EVALUATION FORMULA

The Average Grade PF is calculated as follow:

PF = (EP + EF + PP) / 3

EP: Mid-Term Exam
EF: Final Exam
PP: Average of practices
PP = (P1 + P2 + P3 + P4 + P5) / 5

VIII. BIBLIOGRAPHY

1. **MULAR, A AND BHAPPU R.**
   Mineral Processing Plant Design. Society of Mining and Metallurgy. 946 pp. 1980.

2. **MULAR, A; HALBE, D. AND BARRAT, D.**
   Mineral Processing Plan Design Practice and Control. Proceedings. Society of Mining and Metallurgy. Volume 1 y 2. 2409 pp. 2003.

3. **GUPTA, A AND YAN, D.**
   Mineral Processing Design and Operation. An Introduction. 693 pp. 2006.

IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

Course contributions to Student Outcomes are shown in the following table:

Level 1: Know
Level 2: Comprehend, calculate
Level 3: Model, apply, solve
Level 4: Apply at advanced level, design. Achievement of Student Outcome

Outcome	Contribution
1. Engineering Design Design and integrate metallurgical systems and components satisfying requirements and needs as well as given technical, economic, social and legal constraints and limitations.	4
2. Problem solving Identify, formulate and solve engineering problems properly using the methods, techniques and tools of metallurgical engineering.	4
3. Sciences Application Apply the knowledge and skills of mathematics, sciences and engineering to solve metallurgical engineering problems.	4
4. Experimentation and Testing Conceive and conduct experiments and tests, analyze data and interpret results.	4
5. Modern Engineering Practice Use and apply techniques, methods and tools of modern engineering necessary for the practice of metallurgical engineering.	4
6. Engineering Impact Understand the impact of metallurgical engineering solutions on people and society in local and global contexts.	4
7. Project Management Determine the budgets, schedules and feasibility of engineering projects, and participate in its management for the attainment of goals.	4
8. Environmental Appraisal Take into account the importance of preserving and improving the environment in the development of their personal and professional activities.	4
9. Lifelong Learning Recognize the need to keep their knowledge and skills up-to-date according to advances of metallurgical engineering and engage in lifelong learning.	4
10. Contemporary Issues Know and analyze relevant contemporary issues in local, national and global contexts.	4
11. Ethics and Professional Responsibility Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	4
12. Communication Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	4
13. Teamworking Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	4