



# NATIONAL UNIVERSITY OF ENGINEERING

## COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

### MINING ENGINEERING PROGRAM

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#### GM106 – MINING PLANNING

##### I. GENERAL INFORMATION

<b>CODE</b>	: GM106 Mining Planning
<b>SEMESTER</b>	: 10
<b>CREDITS</b>	: 3
<b>HOURS PER WEEK</b>	: 5 (Theory–Practice)
<b>PREREQUISITES</b>	: GM942 Control of Mining Operations GM931 Analysis of Mining Systems
<b>CONDITION</b>	: Compulsory
<b>DEPARTMENT</b>	: Mining

##### II. COURSE DESCRIPTION

The course corresponds to the area of general training developed in theoretical and practical way. It prepares students in applying the concepts, methods and techniques of descriptive and differential statistics to describe and analyze the data sets and variables through their relevant statistical parameters. Probability concepts are presented and applied to predict future expected values of random variables. Regression techniques are applied to construct models that relate variables of a system or process through representative data processing. Engineering application problems are solved and the use of specialized software is made.

##### III. COURSE OUTCOMES

1. Organize and explains the process of designing an open.
2. Understand the determination of the required number and capacity of the blades.
3. Recognizes the techniques used to perform modeling, financial analysis and economic evaluation.

##### IV. LEARNING UNITS

###### 1. OVERVIEW / 8 hours

Introduction / Definition / Stages of a mining-metallurgical process / First stage: pre mining / Second stage: mining / Third stage: crushed / Fourth stage: processing / Fifth stage: marketing / Conceptual diagram number one / The design process of an open pit / Conceptual diagram number two / Law of the cutoff / Philosophy of the zero section.

###### 2. FUNDAMENTAL CONCEPTS IN MINING PLANNING / 8 hours

Introduction / Parameters that must be taken into account to develop a mining planning / Bench height (BH) / Drilling efficiency (PR) / Efficiency of the blades / Ramp location and haulage routes / Angles of the final limits of a pit / Working angles / Infrastructure for the various in-situ services / Selection of mining method / Introduction / Geological reserves / Mining reserves / Investments available.

###### 3. LAW OF CUTOFF / 12 hours

Definition / What is the law of cutoff? / Factors that influence the cutoff law / End limits of an open pit / Analysis of the final boundaries of a pit / Techniques used to perform modeling blocks / Cutoffs of the final boundaries of a pit / Definition / Practical applications / First application / Calculating the value of a block / Ore block / Clearing block / Design of a pit / Objective / Restrictions on the slopes of the pit / Floating cone method / Stages of the floating cone / Practical applications / Final design of the pit limits / Introduction / Methods

for making the design limits of a pit / The block model for designing a pit / Rectangular blocks / Rectangular blocks divided into small dimensional sub blocks.

#### **4. MID-TERM EXAM / 4 hours**

Interpolation techniques to assign values to each block / Geostatistical: using kriging / Inverse distance / Polygons / The economic value of a block / Most commonly used methods for designing the limits of a pit / Application problems / Removal ranges (SR) / The range of the total average removal / The increasing of the removal range / The periodic removal range / Range of breakeven removal / Life and level of mining production / Mine life / Production level / Pre mining / Sequence and mining planning / Planning short, medium and long term / Application problems.

#### **5. MINING EQUIPMENT SELECTION / 12 hours**

Overview / Rotary drilling / Main factors for selecting the drill diameter / Drill selection / Algorithm / Drilling and blasting variables / Drilling variables / Design variables for rock blasting / Pearse's mathematical model / Operating variables / Practical applications / Selecting shovels and trucks / Introduction / Affecting factors on the number and size in the blades selection / Maximum daily production required / Selecting the trucks size / Mixing systems and their restrictions / Ore and clearing characteristics / Determining the required number and capacity of the blades / Method using the Pascal triangle / Application problems / Rock properties and fluffing factor / Application problems.

#### **6. FINANCIAL ANALYSIS AND ECONOMIC EVALUATION OF INVESTMENT IN MINING PROJECTS / 8 hours**

Introduction / The parameters to be taken into account to analyze ore reserves / Estimated economic parameters / Cash flow analysis / Compound interest / The value of capital over time / Application problems / Financial economic criteria for optimization of mining planning / Introduction / Analysis of the internal rate of return (IRR) / Net present value (NPV) / Assessment of the alternatives in mining planning / Advantages and limitations of applying W.P.V in mining planning / Application problems.

### **V. METHODOLOGY**

The course will be conducted under the face modality with theory, practice and computer lab sessions. In the theory sessions, the instructor introduces the concepts, theorems and applications. In the practical sessions, different problems are solved and their solution are analyzed. In the laboratory sessions, a specialized simulation software is used to solve problems and analyze their solution.

### **VI. EVALUATION FORMULA**

The Average Grade PF is calculated as follow:  $PF = (EP + EF + PPL) / 3$

$$PF = (PL1 + PL2 + PL3 + PL4) / 4$$

**EP:** Mid-Term Exam

**EF:** Final Exam

**PPL:** Average of laboratories

### **VII. BIBLIOGRAPHY**

1. **FLEIDER, E.P.**  
Surface Mining.

2. **CRAWFORD, JHONAND AND HUSTRULID, WILLIAM A.**  
Open Pit Mine Planning and Design.