NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

MINING ENGINEERING PROGRAM

MI109 – MINES VALUATION

I. GENERAL INFORMATION

CODE	**:**	MI109 Mines Valuation
SEMESTER	**:**	10
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (Theory–Practice)
PREREQUISITES	**:**	GM942 Control of Mining Operations GM931Analysis of Mining Systems
CONDITION	**:**	Compulsory
DEPARTMENT	**:**	Mining Engineering

II. COURSE DESCRIPTION

The course prepares students in the methods and techniques for the analysis and economic valuation of mines. Firstly, the importance of mining as economic activity are analyzed, its contribution to GDP, as well as the evolution of metal and mineral process in world markets and the factors affecting it. Students calculate income form mining operations based on metal market prices (present and estimated future), mine production capacity, metallurgical recovery. Methods for estimating mineral resources and reserves are used to project mine useful life-time. Students also analyze how operating costs are generated and classify them, proposing strategies for cost reduction and overall efficiency improvement. The investment process is analyzed, as well as the valuation of mining assets, the requirements of working capital, and the quantification of profitability to justify the mining investment. The time-value of money is analyzed considering interest rate and expected profitability returns. Economics valuation methods used in mining industry are analyzed considering the sensitivities and risks inherent to the mining sector. Students complete a mining valuation project including a strategic planning investment program.

III. COURSE OUTCOMES

At the end of the course, students:

1. Understand the importance of mineral resources in the development of economic activities that satisfy human needs.
2. Analyze the technological, economic, social and environmental factors of the mining activity.
3. Explain the processes that transform ore resources into economic goods traded in international markets governed by supply and demand law.
4. Calculate the economic value of mineral concentration processes based on unit production costs and estimate the sale value of output products considering expected investment return rates.
5. Estimate and analyze variable and fixed costs and their use for calculating the investment equilibrium point, considering a financial structure according to money sources.
6. Understand and analyze the accounting concepts of depreciation, amortization, working capital and rescue value, as well as the concepts of time-value of money in time, net present value and expected future value considering risks inherent to mining activity.
7. Evaluate and estimate the value of properties and real state considering the capacity for generating value and positive cash flows in the future.

IV. LEARNING UNITS

1. **GENERAL ECONOMIC CONCEPTS**
   Price importance in a mixt economy / Supply and demand / National income determination / Savings, expenditures, investment / External environment analysis / Business goals / External environment analysis / Macroeconomic environment / Economic development / Interest rates / Change rate of foreign currency / Inflation rate / Taxes / Industrial environment analysis / Markets / Market features / Demand features / Supply features / Market competition in mining industry / Porter analysis applied to mining industry / Domestic environment analysis / Value chain origin. / Primary activities /Operations.
2. **MINERAL SALES INCOME**
   Mineral reserves / Production / Mineral fineness / Dilution / Mine recovery / Materials balance / Metallurgic balance / Metallic minerals prices / Price indexes / Use of metallic minerals / Metallic minerals market / CIF and FOB prices / Types of contract / Concentrated minerals sales income / Refining.
3. **PRODUCTION COSTS**
   Costs according to production process / Direct costs / Indirect costs / General expenditures / Costs according to production volume / Variable costs / Fixed costs / Marginal analysis / Balance point / Strategic factors / Functional costs / Finances / Economic concepts of depreciation
4. **MINING INVESTMENT**
   Tangible investments / Intangible investments / Depreciation and amortization concepts / Mining investment estimation / Plant investment estimation. / Services investment estimation / Mine closure investment / Mine closure program.
5. **ECONOMIC EVALUATION**
   Value of money in time / Price rate to the consumer / Constant currency value / Financial formula deduction / Evaluation methods / Accountable methods / Investment return / Economic methods / Risk concepts / Market risks / Business risks / Return period / NPV / IRR / EAC / Production optimization / Mining sequence problems / Sensibility and risks analysis / Statistical and probabilistic revision / Risk analysis application / Sensibility analysis application.
6. **FINANCIAL ECONOMIC EVALUATION**
   Capital or investment costs / Ways to finance an investment / Own resources / Financial agents / Loans / Bonds / Associations / Financial rents / Bank fees /.Financial structure / Financial rates estimation.
7. **MINING PROPERTIES VALUATION**
   Mining properties / Rating regulations for litigation issues / Professional ethics / Mining prospect rating / Mining business plans rating / Running mining business rating / Mining equipment and machinery valuation.

V. PRACTICAL EXPERIENCES

1. Session 1: Mining economic and economic indicators.
2. Session 2: Calculation of concentrated minerals value, calculation of mineral value.
3. Session 3: Variable costs problem, fixed costs and marginal contribution.
4. Session 4: Economic evaluation problem.
5. Session 5: Group works revision.
6. Session 6: Group works presentation.

VI. METHODOLOGY

The course is developed in sessions of theory and practice. In theory sessions, the teacher presents concepts, applications and problems. In practical sessions, students carry out topic reviews and discussions, and work to complete an economic mining development project which must be presented and defended.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + 2*EF + PP) / 3

EP: Mid-term Exam EF: Final Exam

$PP = (PC_1 + PC_2 + PC_3 + PC_4 + 2*PRO) / 6$

PP: Average of 4 Practical Works

PC: Practical Works.

PRO: Project Grade

VIII. BIBLIOGRAPHY

1. GENTRY.
   Mine Investment Analysis. SME, 2014.
2. BLANK, TARQUIN.
   Economic Engineering, McGraw Hill, 2010.