



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF METALLURGICAL ENGINEERING

DEPARTMENT OF MINING ENGINEERING

INTRODUCTION TO MINING AND METALLURGY

EMI 1205

Final Examination Paper

June 2020

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr N Ndlovu

INSTRUCTIONS

1. The examination consists of NINE questions, Answer **ANY THREE** questions from section A and **ANY TWO** from section B.
2. Each question carries 20 marks

Additional Requirements

NONE

MARK ALLOCATION

Question 1 to 9	20Marks
Part Questions	As shown in each part question
Total Attainable	100

Section A: INTRODUCTION TO MINING

Question 1: Overview of Mining

- a. Beginning with the definition of mining, detail a comprehensive report on the history of mining as far as civilization is concerned, stating the era's involved. [10]
- b. Define the following terms giving examples where appropriate. [10]
 - i. Mining Engineering [2]
 - ii. Aqueduct [2]
 - iii. Mineral [2]
 - iv. Stripping ratio [2]
 - v. Production operations [2]

Question 2: Stages in the life of a mine {20 marks}

- a. There are different phases of a mining project. List and explain the stages in the life of a mine. [15]
- b. Differentiate between the direct and indirect methods of prospecting. [5]

Question 3: Mining Methods {20 marks}

- a. After a mineral deposit has been discovered, delineated, and evaluated, the most appropriate mining method is selected based on technical, economic, and environmentally accountable considerations. Discuss the classification of surface mining methods. [10]
- b. Using well annotated diagrams, compare and contrast room & pillar mining and cut & fill mining methods. [10]

Question 4: Technological Advancements in Mining {20 marks}

Discuss the technological advancements in the Mining Industry and how these advancements affect the environment and socio-economic conditions. [20]

Question 5: Mine Safety and Health {25 marks}

- a. Discuss the fundamental principle of mine safety. Also define and explain the term MINE SAFETY. [5]
- b. Discuss the physical hazards in the mining industry and the diseases/conditions associated with the hazards. [8]
- c. The tools and machinery used in undertaking mining operations can cause a number of negative health effects to the workers. Discuss this statement linking it to the mechanical hazards in the industry. [5]
- d. Many chemicals are used in mining operations in particular in laboratories and explosives. Explain how these chemicals affect the workers. [2]

Section B: INTRODUCTION TO METALLURGY

Question 6: Overview of Metallurgy and Mineral processing {20 marks}

- a. Using appropriate examples define and discuss the different branches of metallurgy. [10]
- b. List the separation methods used in the physical concentration of minerals. [5]
- c. Define and explain the calcination process. [5]

Question 7: Extractive Hydrometallurgy {20marks}

Leaching is the first stage of extractive hydrometallurgy which involves the transfer of the targeted metal by preferential dissolution of the mineral ore, concentrate or scrap metal. List and explain the leaching processes. [20]

Question 8: Extractive Pyrometallurgy {20marks}

Pyrometallurgy is the extraction of minerals which involves the use of high temperatures well above 100°C by reducing the mineral to the free metal. Explain the unit processes in pyrometallurgy. [20]

Question 9: Refining process {20marks}

- a. Differentiate between electro refining and electrowinning. [6]
- b. Discuss the two types of electrolytic phenomena in electro refining. [6]
- c. Explain the electrolytic decomposition and hence the basic conditions that an electrolyte must satisfy. [6]
- d. Write down the reactions that occur at the cathode and anode of an electrolytic cell. [2]