FACULTY OF ENGINEERING AND THE ENVIROMENT

DEPARTMENT OF MINING ENGINEERING

SMALL SCALE / ARTISANAL MINING

EMN 2209

Final Examination Paper

JUNE 2025

This examination paper consists of 4 pages

Time Allowed : 3 hours

Total Marks : 100

Examiner's Name : Miss B. Ncube

INSTRUCTIONS

1. This paper contains One section with 5 questions.
2. Answer Question One (25 marks) and any other Three Questions (25 marks each).
3. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
4. Start each question on a new page.

NB; DO NOT OVERTURN THE QUESTION PAPER OR COMMENCE WRITING UNTIL INSTRUCTED TO DO SO.

Additional requirements

Non-programmable calculator.

MARK ALLOCATION

Question 1 to 5	**25 Marks**
Part Questions	**As shown in each part question**
Total Attainable	**100**

ANSWER QUESTION ONE and ANY OTHER THREE QUESTIONS

QUESTION ONE

Give detailed information on the following ownership models in small scale mining;

(a)i) Project ownership models [5 marks]

ii) Exploration techniques [4 marks]

iii) Mining system [4 marks]

(b) Discuss the following processes in small-medium scale mining

i) mercury amalgamation process [4 marks]

ii) panning [4 marks]

iii) sluicing [4 marks]

Explain how they affect gold mining operations. What are the risks involved in these processes.

QUESTION TWO

As a small-scale gold producer on Zimbabwe's Filabusi Archean granite-greenstone belt, create a concise but detailed funding project proposal to present to a possible investor interested in Freda's tribute mining concept. [25 marks]

QUESTION THREE

a) How would you redesign a model of a sustainable small to medium scale gold mine with three parameters in mind?

- Production cycle
- Processing of gold
- Revenue generation

Given that the mine was commissioned 36 months ago and has failed to break even and you have also been provided with information in Table 1.0 below:

Table 1.0: Production, processing and tailings generated at mine

Tonnage per annum	480 tonnes
Hammer consumption	0.9kg/t
Average grade	19g/t
Diesel consumption	40 litres/tonne
Mill capacity	1.6t/hr
Costs of other consumables	US$383/t
Rate of recovery of gold	49.7%
True Content of gold in tailings	9.7g/t

- Assumption: Price of gold remains at $ 1 249. 20 per ounce for the next 6 months 1 ounce is equal to 28.34 g
- Note: Four separate zones with mineral deposits have been identified that represent three specific types of mineralization: high grade gold-bearing quartz veins; strata bound quartz stockwork and supergene enriched gold mineralization on overlying quartz stock work.

[15 marks]

b) Discuss two other factors considered in designing or remodeling a sustainable small to medium scale gold mine. [10 marks]

QUESTION FOUR

a) Discuss the key provisions of the **Mines and Minerals Act (Chapter 21)** that govern the operations of small-scale mining in Zimbabwe. [8 marks]

b) Explain the process and legal procedures for acquiring a small-scale mining license under the **Mines and Minerals Act (Chapter 21)** in Zimbabwe. Discuss the steps involved from application to issuance and the role of the Ministry of Mines and Mining Development during this process. [9 marks]

c) Discuss how the **Environmental Management Act (Chapter 20:27)** influences the application process for small-scale mining operations in Zimbabwe. In your answer, focus on the key requirements for environmental compliance that must be met during the application phase. [8 marks]

QUESTION FIVE

a) Explain 3 recent technological advancements in gold processing methods adopted by small-scale miners in Zimbabwe. Discuss the use of these technologies and how they improve gold recovery rates and reduce environmental hazards typically associated with traditional gold processing methods. [9 marks]

b) Discuss 3 specific AI applications that could address key challenges faced by small-scale miners in Zimbabwe. [9 marks]

c) Despite its potential benefits, the adoption of AI in small-scale mining faces several barriers in Zimbabwe. Discuss the challenges that small-scale miners might face in integrating AI technologies into their operations. Propose potential solutions to overcome these barriers. [9 marks]

-END OF EXAMINATION-