



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

SMALL SCALE/ ARTISANAL MINING

EMI 2209

Final Examination Paper

JULY 2022

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr. P. Matshona

INSTRUCTIONS

1. This paper contains **ONE** section with **SIX** questions.
2. Answer **QUESTION ONE** and **any other FOUR** questions.
3. Each question **carries 20 marks**.
4. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
5. Illustrate your answer, where appropriate, with large clearly labelled diagrams.
6. Start each question on a new page.

Additional Requirements

Calculator

MARK ALLOCATION

| | |
|-------------------------|---------------------------------------|
| Question 1 to 6 | 20 Marks |
| Part Questions | As shown in each part question |
| Total Attainable | 100 |

Question One

Leveraging on your understanding of the three pillars of mining in Artisanal and Small-scale Mining (ASM), describe possible promotion measures for the various stages of ASM production under the following guiding headings:

- (a) Exploration **[5 marks]**
- (b) Mining, exploitation **[5 marks]**
- (c) Processing and beneficiation **[5 marks]**
- (d) Marketing **[5 marks]**

Question Two

As with all economic development strategies, for small to medium scale miners ‘growth stimulation to occur there is need to invest in entrepreneurship development. Exactly what and how much you need to invest will depend on the types of entrepreneurs you want to develop. Critically discuss:

- (a) What are the shortcomings of artisanal small-scale miners that need to be improved for them to contribute to the sustainable economic development of Zimbabwe? **[10 marks]**
- (b) What clusters (backward and forward linkages) do you hope to advance with entrepreneurship development in this mining sector? **[10 marks]**

Question Three

Zimbabwe ratified the Minamata Convention on Mercury which was signed in October 2013 after it had been proven through various research studies “that artisanal and small-scale gold mining and processing in its territory is more than insignificant.” As a critical stakeholder in the Artisanal Small-scale Gold Mining (ASGM) sector explain:

- (a) Two methods of reducing open air burning of mercury gold amalgamation by ASGM **[6 marks]**
- (b) Three mercury free methods of gold processing that could be used by ASGM miners. **[9 marks]**
- (c) What are the possible policy measures that could be put in place in Zimbabwe to reduce the use of mercury by ASM. **[5 marks]**

Question Four

- (a) Considering the legal framework governing small to medium scale miners in Zimbabwe, clearly outline fundamental gaps (lacuna) and/or challenges in the current Mines and Minerals Act Chapter 21:05 administered by the Ministry of Mines and Mining Development (MMMD)

[12 marks]

- (b) As a mining engineer, what amendments would you make to the current Mines and Minerals Act Chapter 21:05 to create a win-win situation for the ASM miners and Government of Zimbabwe.

[8 marks]

Question Five

- (a) From an international perspective, what best practices would you suggest being adopted by the Chamber of Mines in Zimbabwe (CoMZ) to initiate and promote the concept of co-existence and integration strategies for the Artisanal Small-scale Miners and Large-Scale Miners.

[13 marks]

- (b) Highlight one such best practice that has seen great success in Zimbabwe and why the concept was accepted by both small scale and industrial miners.

[7 marks]

Question Six

Identify and explain in detail five negative environmental impacts of artisanal small-scale mining which have a high severity and for each identified impact suggest practical mitigation measures. **[20 marks]**

Question Seven

How would you redesign a model of a sustainable small to medium scale gold mine with three (3) parameters in mind?

- i. Production cycle
- ii. Processing of gold
- iii. Revenue generation

Given that the mine was commissioned 3 years ago and has failed to break even and you have also been provided with information in Table 1.

Table 1 Production, processing and tailings generated at mine

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

[20 marks]