



FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

MINING METHODS

EMI 2205

Final Examination Paper

July/August 2022

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr B MLAMBO

INSTRUCTIONS

1. Answer any other **FOUR (4)** questions.
2. Each question carries **25** marks
3. Use of calculators is permissible

Additional Requirements

Calculator

MARK ALLOCATION

| | |
|-------------------------|---------------------------------------|
| Question 1 to 5 | Total 25 marks |
| Part Questions | As shown in each part question |
| Total Attainable | 100 marks |

QUESTION 1

After extensive and detailed exploration work the following information has been gathered for the mineral deposit that is to be mined if the feasibility studies guarantee the decision to carry out mining operations on the geological formation:

- Ore is steeply dipping (dip $>50^\circ$) and the dip is exceeding the natural angle of repose of the ore material.
 - Competent ore
 - Comparatively stable hanging wall and footwall
 - Regular ore boundaries
 - Ore is not affected by storage in the stopes
- a. The geological information is presented to you by the exploration company and as the Senior Mining Engineer for your Mining entity. Select the appropriate mining method for this ore deposit so as to efficiently and economically exploit the mineral resource. **[1]**
- b. Describe the layout, development, production ore handling sequences, advantages and disadvantages of this mining method. Use sketch diagrams, sections or plans to clearly outline your mining method of choice to senior project managers and investors. **[16]**
- c. Briefly outline the guidelines for selecting an underground mining method. **[8]**

QUESTION 2

- a. Define the term dilution and highlight the causes and drawbacks of dilution in underground mining operations. **[10]**
- b. GSU Mining Company is a chrome mine that has 12 production sections and two blasting shifts per day. Each section is required to blast a stope 21.0m in width per shift. Stopes are available as 6m gulleys and 9m panels. A gully has 51 holes and only 3 are reamed at the 9-hole burn cut and not charged. All the 52 holes on a panel are charged. Holes are drilled to 3.2m depth. The budgeted advance is 2.8m and the mining height is 2.0m.

One Megamite stick, 0.25kg in weight is loaded into each hole for priming and ANFO is used as main column charge. The ANFO is bagged into 25kg bags

Table 1: Explosive consumption per stope.

| END | 6M GULLEY | 9M PANEL | 6M GULLEY | 9M PANEL |
|---------------------------|-----------|----------|-----------|-----------|
| Quantity required per end | 7 bags | 8 bags | 48 sticks | 52 sticks |
| Explosive Type | ANFO | MEGAMITE | | |

Table 2: Unit cost of the explosives used.

| Product | ANFO fertilizer | Megamite | Diesel |
|---------------|-----------------|------------------|--------|
| Cost per unit | \$0.83/kg | \$1.78 per stick | \$1.20 |

Calculate:

- i) Budgeted tonnage of blasted ore per 6m gulley per shift [2]
- ii) Budgeted tonnage of blasted ore per 9m panel per shift [2]
- iii) Number of ANFO fertilizer bags required per section per month [1]
- iv) Cost of fuel per month per section [1]
- v) Cost of explosives per month per section [2]
- vi) Budgeted powder factor on a gulley [2]

Assumptions:

- Rock density is 3.15t/m³ and 30 working days per month on full production.
- One 25kg bag of fertilizer requires 1.5l of diesel to achieve an optimum mixing ratio for ANFO

- c. Explain the advantages that exist of hydraulic drilling machines over pneumatic drilling machines. [5]

QUESTION 3

- a. Compare and contrast the Shrinkage and sub-level Mining Methods with special emphasis on the following:
 - Geology, ore body Shape, size and Orientation
 - Host and ore rock properties
 - Ground support

- Mechanization
 - Production rate
 - Dilution and recovery
- [15]**

b. With the aid of a sketch show the mining openings

- Shaft
 - Cross cut
 - Drift
 - Raise
 - Winze
- [5]**

c. Write short notes on the following:

- Stemming
 - Fly rock
- [5]**

QUESTION 4

Discuss the advantages and disadvantages of three types of loading equipment and two types of haulage equipment used in surface mines. Under what circumstances would each type be most suited?

[25]

QUESTION 5

A thick and tubular deposit has been identified to be hosting high grade diamond ore. The deposit has the following characteristics:

- Dip angle of 63° ;
- General thickness of 45m;
- Irregular ore-waste boundaries;
- Angle of repose for waste material is 43° ; and
- Outcrop on the surface covers a diameter of 53m.

The findings from trial mining suggest that the expected ore recovery is **80%** at a selling price of **US\$ 16,875** per tonne, while the waste mining cost is **US\$ 2,730** per tonne and ore mining cost is **US\$ 4,425**. In addition, two bench scenarios have been determined to extract the ore body.

Scenarios:

A. 10 working benches of height 30m.

B. 20 working benches of height 15m.

- i. Select the best mining method and explain its suitability for exploiting this mineralisation. **[3]**
- ii. Suggest the most appropriate stripping ratio technique suitable for this deposit. **[1]**
- iii. Highlight advantages of the selected stripping ratio technique **[4]**
- iv. Propose the maximum allowable stripping ratio for this deposit. **[4]**
- v. Discuss the consequences of implementing each of the bench scenarios given that appropriate machinery is available for both options.
[10]
- vi. Suggest the most appropriate waste dumping method. Explain your answer. **[3]**

END OF EXAMINATION