



**FACULTY OF ENGINEERING AND THE ENVIRONMENT**  
**DEPARTMENT OF MINING ENGINEERING**  
**SURFACE MINE TECHNOLOGY**  
**EMI 2107**

**Final Examination Paper**

**September 2023**

This examination paper consists of 3 pages

Time Allowed: 3 hours.  
Total Marks: 100  
Examiner's Name: Mr A Antonio

**INSTRUCTIONS**

1. This paper contains **ONE** section with **FIVE** questions.
2. Answer any **FOUR** questions.
3. Each question carries 25 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 labeled diagrams.
6. Start each question on a new page.
7. This paper comprises 3 printed pages.

Additional Requirements

Calculator

## QUESTION ONE

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

- Dip angle of  $65^{\circ}$ ;
- General thickness of 50m.
- Irregular ore-waste boundaries.
- Angle of repose for waste material is  $43^{\circ}$ ; and
- Outcrop on the surface covers a diameter of 53m.

The findings from trial mining suggest that the expected ore recovery is **85%** at a selling price of **US\$ 19,965** per tonne, while the waste mining cost is **US\$ 3,530** per tonne and ore mining cost is **US\$ 4,625**. In addition, two bench scenarios have been determined to extract the ore body.

### Scenarios:

- A. 10 working benches of height 25m.
- B. 20 working benches of height 15m.

- Select the best mining method and explain its suitability for exploiting this mineralisation. **[3]**
- Suggest the most appropriate stripping ratio technique suitable for this deposit. **[1]**
- Highlight advantages of the selected stripping ratio technique **[4]**
- Propose the maximum allowable stripping ratio for this deposit. **[4]**
- Discuss the consequences of implementing each of the bench scenarios given that appropriate machinery is available for both options. **[10]**
- Discuss 3 factors that influence equipment selection in the mining method that you have chosen. **[3]**

## QUESTION TWO

a) A newly appointed Chief Executive Officer, of the company you work for, has visited the open pit at which you are employed as Pit Superintendent. As he is observing the operations, he asks you why the company is incurring costs of transporting waste material from the pit and dumping it outside instead of within the pit. How would you articulate to him the necessity of ex-pit waste dumping for this mining method?

[12]

b) i. Describe five (5) factors that influence the site location selection of a waste dump.

[10]

ii. Specify geometric variables which affect the stability of a waste dump. [3]

## QUESTION THREE

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 FOUR

a. Briefly discuss 8 blast design factors that are critical for a successful blast.

[16]

b. What do you understand by the term pre-splitting and what are the 3 reasons for pre-splitting in open-pit blasting?

[4]

c. Briefly discuss the importance of powder factor in blasting.

[5]

## QUESTION FIVE

With the aid of a neat sketch, illustrate the following terms used in surface mining: overall pit slope, berm width, toe, berm angle, bench angle, bench width, ramp, pit floor. What is the significance or purpose of each of these? [25]