FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

SURFACE MINING

EMI 5202

Final Examination Paper

June 2024

This examination paper consists of 3 pages

Time Allowed: 3 hours.

Total Marks: 100

Examiners 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 labelled diagrams.
6. Start each question on a new page.
7. This paper comprises 4 printed pages.

Additional Requirements

Calculator

QUESTION ONE

a. What are the key geological factors to consider when selecting a surface mining method for a mineral deposit? Provide examples to illustrate their significance. **[5 Marks]**

b. Discuss the distinguishing features between strip mining and open pit mining. What is the impact of each method on environmental rehabilitation and restoration? **[15 marks]**

c. A mining operation at Tonie Gold Mine uses a loader to load material into trucks for hauling. The loader has a productivity of 250 tons per hour, and the trucks have a capacity of 40 tons each. The average cycle time for the loader to load a truck is 15 minutes. The total time for a complete loading and hauling cycle, including travel time, is 45 minutes. Calculate the match factor for the loading and hauling process at Tonie Gold Mine. **[5 Marks]**

QUESTION TWO

a. A mining operation is planning to extract ore from an underground deposit using a drop-cut method. The deposit has a vertical extent of 300 meters and is accessed through a decline tunnel. The mining engineer needs to determine the location for the drop cut. Provide a detailed explanation of the factors to consider when selecting the drop-cut location and justify your answer.

[6 Marks]

b. Describe the consequences of stresses in open pit mining and provide a labelled diagram illustrating one of these consequences. **[5 Marks]**

c. A mining company plans to extract gold from a deposit using a geometric sequencing approach. The initial extraction rate is 500 ounces per year, and the common ratio is 1.2. Determine the total gold extraction over the first eight years. **[6 Marks]**

d. Explain the Declining Stripping Ratio method in open pit mining. Provide a diagram to illustrate this method. **[7 Marks]**

QUESTION THREE

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

[16 Marks]

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

[4 Marks]

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

[5 Marks]

QUESTION FOUR

Hwange Colliery Mine has identified a thick and tubular deposit hosting high-grade coal. The deposit exhibits the following characteristics:

- Dip angle: 65°
- Average thickness: 50m
- Irregular boundaries between coal and waste material
- Angle of repose for waste material: 43°
- Surface outcrop diameter: 53m

Results from trial mining indicate an estimated ore recovery of 85% at a selling price of US$ 22 per tonne, with waste mining costs at US$ 7 per tonne and ore mining costs at US$ 12 per tonne. Two bench scenarios have been proposed for extracting the coal seam:

Scenario A: 10 working benches with a height of 25m.

Scenario B: 20 working benches with a height of 15m.

Answer the following questions:

i. Choose the optimal mining method and provide an explanation of its suitability for exploiting the coal deposit at Hwange Colliery Mine. **[3 marks]**

ii. Recommend the most suitable stripping ratio technique for this deposit. **[1 mark]**

iii. Discuss the advantages of the selected stripping ratio technique. **[4 marks]**

iv. Propose the maximum allowable stripping ratio for this deposit. **[4 marks]**

v. Analyze the potential consequences of implementing each bench scenario, assuming appropriate machinery is available for both options. **[10 marks]**

vi. Identify and discuss three factors that influence equipment selection in the chosen mining method at Hwange Colliery Mine. **[3 marks]**

QUESTION FIVE

a. Explain any **5** factors which influence waste dump site location. **[10 Marks]**

b. Explain how the following influence waste dump stability:

- Foundation conditions.
- Dump geometric configuration.
- Dump material properties.
- Seismicity and dynamic stability.
- Dumping method.

[15Marks]