



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

MINE DESIGN

EMI 5203

Final Examination Paper

August 2021

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Eng. T. Nyamagudza

INSTRUCTIONS

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

Additional Requirements;

Scientific Calculator

MARK ALLOCATION

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

Question 1

In an underground mine, production is at 1Mt of ore. The ore reserve is 10Mt. The market demand limits the ore to 1Mtpy. The total production cost is \$60 000/t

And the revenue is \$90 000/t.

The company has just found a smaller deposit of 1Mt in the hanging wall. This deposit must be mined immediately or left and cannot be mined in the future because of the caving hanging wall. The revenue will be the same as for the main deposit, but the mining cost will be higher at \$75 000/t

Is it profitable to mine the newly found smaller deposit?

The discount rate has been determined to be 15%.

[20]

Question 2

(a) What are the three distinct components of an ore body model? [6]

(b) The inverse distance weighting technique is widely used in the mining industry. Briefly explain how the influence of closer samples can be made to have more weighting than further samples. [4]

(c) Produce such an estimator for the prediction of a grade at location X=235, Y=155 using the data listed below. [10]

Sample Number	X	Y	Value
1	195	225	2.261
2	355	225	0.174
3	355	345	0.203
4	263	365	0.215
5	185	75	0.241
6	25	445	0.2

Question 3

(a) Discuss the any five (5) challenges associated with mine planning. [10]

(b) The sequence of mining has an impact on the waste to ore ratio and ultimately on the financial model for the project. Discuss how the mining sequence indicated in figure 3.1 affect the accumulation of costs and revenue as mining proceed. [10]

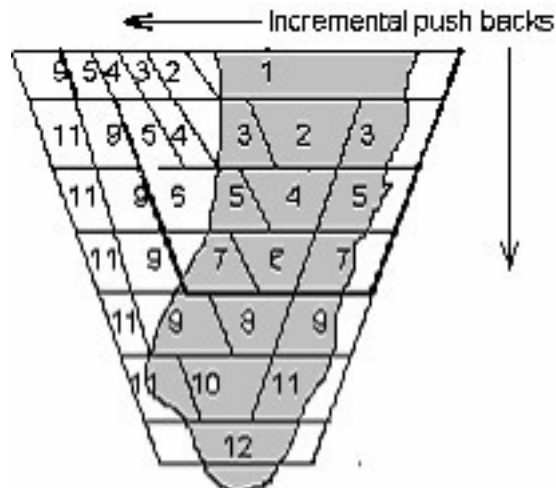


Figure 3.1: mining sequence with incremental push backs.

Question 4

- (a) Briefly explain the incremental pit expansion method for pit definition. [5]
- (b) The hypothetical property shown in the figure below represents a vertical section through a block model of the property's deposit. Each square represents the net value of a block if it were independently mined and processed. Determine the pit outline that gives the maximum profit using Lerchs Gossman Technique.

	1	2	3	4	5	6	7	8
1	-1	-1	-1	-1	-1	-1	-1	-1
2	-2	-2	1	-2	2	1	2	-2
3	-3	-3	3	4	-1	4	-3	-3

[15]

Question 5

- (a) Explain the approaches / techniques used to estimate annual production capacities for mining projects. [5]
- (b) Explain how the following affect the size of an underground mine;
- Market conditions and the price of the product.
 - The grade of the mineral and the corresponding reserve tonnage.
 - The effect of the time required before the property can start producing.

[15]

Question 6

- (a) Discuss the fundamental aspects required for the planning and designing of a water management system for a deep underground mine operation. **[10]**
- (b) Explain the steps you would take when planning for ventilation requirements for an underground greenfield mining project. **[10]**

The End!