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#### MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY

**DEPARTMENT: MINING AND MINERAL PROCESSING ENGINEERING**

**MODULE: MINE DESIGN AND PLANNING**

**CODE: HMIE 515**

### SESSIONAL EXAMINATIONS

**JUNE 2023**

**DURATION: 3 HOURS**

**EXAMINER: D. DHLIWAYO**

## INSTRUCTIONS

1. *Answer* ***All*** *in Section A*
2. *Answer any other* ***Four (4)*** *questions in Section B.*
3. *Start a new question on a fresh page*
4. *Total marks 100.*

***Additional material(s):*** *Calculator*

**SECTION A**

*(Answer all questions in this section)*

**Question 1**

Consider the deposit shown below. The copper content varies in different blocks, ranging from less than 0.2% Cu to over 2.5% Cu. The depiction can be a section of a horizontal deposit suitable for surface mining or a plan/section through a deposit to be mined underground. It is assumed that any part of deposit can be mined independently of the adjoining parts. There are 30 blocks or areas in the deposit, each with 1 Mt of ore.

Copper deposit with varying copper contents, % Cu

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **0.6** | **0.6** | **0.9** | **0.3** | **1.0** | **0.5** | **0.3** | **0.7** | **0.5** | **0.4** |
|  | **0.6** | **0.7** | **0.8** | **0.3** | **0.6** | **0.9** | **1.5** | **1.9** |  |
|  |  | **1.5** | **2.0** | **1.8** | **2.6** | **2.0** | **2.6** |  |  |
|  |  |  | **2.5** | **2.5** | **2.0** | **2.6** |  |  |  |
|  |  |  |  | **2.5** | **2.5** |  |  |  |  |

The profitability study shows the following:

Average copper content 1.34%

Mining cost $12 000 / t

Processing cost $24 000 / t of ore

Smelting cost $3.6 million / t of refined copper

Refining cost $1.5 million / t of refined copper

Recovery 90%

Fixed investment $1.2 trillion

Copper price $12 million / t of refined copper

1. How large a part of this deposit is worth mining? [5]
2. What is the total profit/loss if the whole deposit is mined? [5]
3. What is the cut-off grade? [5]
4. How much will the profit increase by using the right cut-off grade? [5]

**SECTION B**

(*Answer any 4 questions in this section. Each question carries 20 marks)*

**Question 2**

1. Discuss the significance of geo-statistical analysis in mineral resource evaluation. [3]
2. Discuss the significance of bench height in open pit mine planning and design. [5]
3. Discuss the **Depth** effect and the **Slope** effect in Open Pit Planning. [6]
4. Describe any **ONE** of the conventional techniques used for reserve estimation. [6]

**Question 3**

1. Explain the development sequence for room and pillar mining on the Great Dyke. [5]
2. Describe briefly with the aid of diagrams how alluvial deposits are mined. [6]
3. Discuss the three areas that require reclamation at any mine operation. [9]

**Question 4**

1. Consider a hypothetical property shown in the figure below. The figure represents a vertical section through a block model of the property’s deposit and each square represents the net value of a block if it were independently mined and processed.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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 |

Determine the pit outline that gives the maximum profit using Lerch’s-Grossman technique. [10]

1. Define production scheduling and discuss the various types of production scheduling. [10]

**Question 5**

1. Discuss the different face cutting approaches in strip mining. [5]
2. Illustrate how you would determine the principle blasting parameters in underground stoping operations. [6]
3. Discuss the factors to consider when designing waste dumps. [9]

**Question 6**

1. Define compositing and discuss two types of compositing. [5]
2. Outline the sequence of development for sub-level mining methods. [5]
3. Determine stripping ratio for a coal mine seam using data shown in Table 2.1 below. [10]

***Table 2.1: Coal seam data***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COAL SEAMS: BLOCK XI** | | | | |
| Sr No | Seam Number | Top (Meters) | Bottom (Meters) | Coal Thickness (Meters) |
| 1 | 1 | 227.70 | 228.48 | 0.78 |
| 2 | 2 | 231.10 | 232.86 | 1.76 |
| 3 | 3 | 235.36 | 235.84 | 0.48 |
| 4 | 4 | 244.20 | 245.43 | 1.23 |
| 5 | 5 | 245.98 | 246.46 | 0.48 |
| 6 | 6 | 247.16 | 250.43 | 3.27 |
| 7 | A | 250.75 | 251.00 | 0.25 |
| 8 | 7 | 256.16 | 257.04 | 0.88 |
| 9 | 8 | 261.26 | 261.49 | 0.23 |
| 10 | 9 | 275.78 | 276.68 | 0.90 |

**END OF EXAMINATION**