#### MANICALAND STATE UNIVERSITY

#### OF

#### APPLIED SCIENCES

FACULTY OF ENGINEERING

**MINING AND MINERAL PROCESSING ENGINEERING DEPARTMENT**

**MINE DESIGN AND PLANNING**

**CODE: HMIE 515**

### SESSIONAL EXAMINATIONS

**MAY/JUNE 2019**

**DURATION: 3 HOURS**

**EXAMINER: NYAMAGUDZA T**

## INSTRUCTIONS

1. *Answer* ***Any Five*** *questions*
2. *Each question carries 20 marks*
3. *Total marks 100*

**Question 1**

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

**Question 2**

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 **[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 |

**Question 3**

Develop a production plan for Iron Ore deposit mine with the following conditions;

Mining method to be used - Sublevel Caving.

The iron content is 47% and the mine is to supply a palletizing plant with annual capacity of 3.2 mil t/a. The simplified ore body is 1000 m long and 100 m wide, Each slice is 10 m high, and there are 10 m between cross cuts, each of which has an area of 20 m2. The density of the ore is 3.5tm-3. The spacing between rings is 2 m and the extraction 100%. The iron content is 65% pellets and 5% tailings. **[20]**

**Question 4**

1. Table 4.1 represents a vertical section through a block model of a deposit. Each square represents the net value of a block if it was to be mine and processed independently. Use the Lerchs-Grossman method to develop an optimal pit based on the given vertical section and compute the net value of the optimal pit. **[12]**

***Table 4.1:*** *Vertical section showing the net value of each block.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| **1** | -$2 | -$2 | -$4 | -$2 | -$2 | -$1 | -$2 | -$3 | -$4 | -$4 | -$3 |
| **2** | -$5 | -$4 | -$6 | -$3 | -$2 | -$2 | -$3 | -$2 | -$4 | -$5 | -$5 |
| **3** | -$6 | -$5 | -$7 | **$6** | **$13** | -$2 | -$5 | -$4 | -$7 | -$4 | -$6 |
| **4** | -$6 | -$6 | -$8 | -$8 | **$17** | **$8** | **$5** | -$6 | -$8 | -$9 | -$7 |
| **5** | -$7 | -$7 | -$8 | -$8 | **$6** | **$21** | **$5** | -$8 | -$8 | -$9 | -$7 |
| **6** | -$7 | -$9 | -$9 | -$8 | -$5 | **$22** | -$8 | -$8 | -$8 | -$9 | -$8 |
| **7** | -$8 | -$9 | -$9 | -$9 | -$8 | **$10** | -$9 | -$9 | -$9 | -$9 | -$9 |

1. Define production scheduling and discuss the various types of production scheduling. **[8]**

**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**

Consider the deposit shown below. The copper content varies in different blocks, ranging from less than 0.25% 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 it 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]**

**END OF QUESTION PAPER**