FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

TECHNICAL VALUATION

EMI 3102

Final Examination Paper

January 2020

This examination paper consists of 6 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr A.A Mukichi

INSTRUCTIONS

1. This question paper consists of 6 questions, **YOU MUST ANSWER QUESTION ONE (1)** and **ANY OTHER THREE (3) QUESTIONS.**
2. Each question carries 25 marks
3. Answer each question on a new page and write as eligible as possible
4. List of formulae is attached at the end of the exam

Additional Requirements:
Non-Programmable Calculator

MARK ALLOCATION

Question 1 to 6	**25Marks**
Part Questions	**As shown in each part question**
Total Attainable	**100**

Question 1 (25 marks)

a) Imagine yourself as the exploration geologist for A.A.A mines and you are required to change resources at your mine into reserves. Briefly describe the modifying factors you would consider. **[10marks]**

b) You are required to calculate the grade of an unknown exploration drill-hole using IDW given the information below.

Table 1: Showing grade and distance from unknown point

Grade, g/t	Distance from the unknown hole, m
4.7	5
3.8	6
6.3	4

[5marks]

c) Table 2 shows exploration data from a phosphate deposit. Given the data in Table 2, you are required calculate the correlation coefficient for the following data and comment on the relationship between depth and grade.

Table 2: Showing the variation of grade and depth

Depth/m,	0	1	2	3	3	5	5	5	6	7	7	10
Grade/%	96	85	82	74	95	68	76	84	58	65	75	50

[10marks]

Question 2 (25 marks)

a) ROM ore from different sections of a platinum mine were heaped separately as heap 1 to 5 and sampling was done and the grades were observed as shown in Table 3. Calculate the weighted mean grade for the platinum deposit with grades and tonnage as shown in Table 3.

Table 3: Tonnage and grade of platinum

Heap	Tons (t)	Grade (g/t)
1	10	12.6
2	28	6.7
3	12	10.2
4	5	20.3
5	15	5.8

[5marks]

b) For scheelite concentrates the price shall be 45 US$/unit WO3. A deposit has grades of 0.85% WO3. This ore has to be beneficiated first before yielding a saleable product. Recovery is assumed to be 90 %. Calculate the return from 1 t of in situ ore with 0.85% WO3.

[5marks]

c) What are the limitations of grade-tonnage curves? **[5marks]**

d) Discuss the significance of the Mine call factor in the mining industry. **[10marks]**

Question 3 (25 marks)

a) As a technical services manager for Chakasara mine, you are required to control the quality of assay results. Describe five ways in which you are going to control the quality of the assay results from the sampling your team is carrying out.

[10marks]

b) The regression equation for the following data is $\hat{y} = 1.2x - 3.8$. Find the standard error of estimate given x_i, and y_i in Table 4.

Table 4: x_i and y_i

x_i	y_i
1	– 3
2	– 1
3	0
4	1
5	2

[10marks]

c) Explain the meaning of "competent person" with reference to the SAMREC code.

[5marks]

Question 4 (25 marks)

a) Define the following terms

i. Dilution
ii. Pay limit
iii. Real losses
iv. Mineral resources
v. Mineral reserves **[10marks]**

b) Determine the recovery and the concentration factor (KF) for the following data from a zinc mine:

- ✓ feed grade=11% Zn
- ✓ concentrate grade=67% Zn
- ✓ tailings grade=0.45% Zn **[5marks]**

c) Briefly describe five sampling techniques that are used in mining projects.

[10marks]

Question 5 (25 marks)

a) Explain the importance of taking samples at every stage of a mining project.

[5marks]

b) The total cost is US$38 to mine a gram of gold, recovery of 95% and assume that the gold price is US$622 per ounce. Calculate the cut-off grade. **[5marks]**

c) Justify the reporting of resources and reserves using SAMREC and JORC reporting codes. **[5marks]**

d) You are a newly appointed general manager for A.M mines, and you are currently on development stage. GSU students ask you about a detailed explanation on all the stages involved in a life cycle of a mining project.
[10marks]

Question 6 (25 marks)

a) List any five ways you would control the grade of ore at a mine. **[5marks]**

b) Give a scientific critique of Gy Pierre's theory of sampling. **[10marks]**

c) What are the effects of dilution on your mining operation? **[5marks]**

d) Imagine you are the duty mine captain and the geologist is not around. You are required to determine the propagation of errors when the percentage error for sampling, transportation and assaying are 3%, 7% and 5% respectively.
[5marks]

List of formulae

$$E = t_c s_e \sqrt{1 + \frac{1}{n} + \frac{n(x_0 - \bar{x})^2}{n\sum x^2 - (\sum x)^2}}.$$

$$t = \frac{r}{\sigma_r} = \frac{r}{\sqrt{\frac{1 - r^2}{n - 2}}}$$

$$s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}}$$

$$s_e = \sqrt{\frac{\sum (y_i - \hat{y}_i)^2}{n - 2}}$$

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2}\sqrt{n\sum y^2 - (\sum y)^2}}$$

$$\sigma_n = \sqrt{\mu_n}$$

$$\sigma_r = \frac{1}{\sqrt{\mu_n}}$$

$$\sigma_{FE}^2 = C d_N^3 \left(\frac{1}{M_S} - \frac{1}{M_L}\right) \quad C = f \cdot g \cdot \beta \cdot c$$

$$\beta = \sqrt{\frac{L}{d}}$$

$$s_x = \sqrt{\sum s_i^2}$$

$$\frac{\sum_{i=1}^{s}\frac{z_i}{d_i^k}}{\sum_{i=1}^{s}\frac{1}{d_i^k}}$$

$$F = \frac{S_1^2}{S_2^2}$$

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$$

$$\hat{y} = mx_i + b$$

$$m = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$