FACULTY OF ENGINEERING AND ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

ORE DRESSING & EXTRACTION

EMI 2104

Final Examination Paper

June 2020

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr A.A Mukichi

INSTRUCTIONS

1. This question paper consists of one section with 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.

Additional Requirements:
Non-Programmable Calculator

MARK ALLOCATION

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

NB: DO NOT TURN OVER THE QUESTION PAPER OR COMMENCE WRITING UNTIL INSTRUCTED TO DO SO

Question 1 [25 marks]

a) Briefly describe CIS, CIP and CIL used in hydrometallurgical processing of gold. **[6marks]**

b) The throughput of a grinding mill is 20tph. If the Bond Work index of the ore is 13.45 kWh/t, what is the energy required by the crusher in reducing the feed size F80 from 600 mm to a product size P80 of 100 mm. **[10marks]**

c) Profitability in mining industry depends on how efficiently the in-situ rock is converted into the final product. Optimizing mining and processing operations separately can fail to recognize the potential benefits that can be achieved by optimizing the entire process. Discuss some of the benefits of optimizing the overall process? **[5marks]**

d) What are the factors that influence the choice of a Lixiviant? **[4marks]**

Question 2 [25 marks]

a) Imagine you are the newly appointed plant metallurgist and you are required to make a choice of options between AG and SAG mills. In your own understanding, explain the factors that you will consider in making that choice. **[5marks]**

b) Particles produced from crushing have different sizes and shapes, can be separated over screens that allow particles that are less than the aperture of the screen to pass through while retaining the others. List any five types of screens that are used in mining. **[5marks]**

c) Name 3 types of cells found in a flotation system and give the use of each cell. **[6marks]**

d) Outline the advantages and disadvantages of dense medium separation **[5marks]**

e) Explain the similarities and differences between the following terms as they are related to ore dressing and extraction.
   i. Frother/collector
   ii. Ore/mineral **[4marks]**

Question 3 [25 marks]

a) Describe with the aid of a clearly labelled flow diagram the processing of platinum using mineral processing method, from crushing to refining. **[10marks]**

b) What are the advantages and disadvantages of upstream method of tailings-dam construction? **[4marks]**

c) What are the similarities and difference between screening and classification? **[4marks]**

d) The feed to a flotation plant assays 0.9% copper. The concentrate produced assays 23% Cu, and the tailings 0.11% Cu. Calculate:

i. Recovery of copper to the concentrate,
ii. Ratio of concentration,
iii. Enrichment ratio. **[7marks]**

Question 4 [25 marks]

a) Why is it important to recover water in a metallurgical plant? **[5marks]**
b) Solvent extraction is currently the dominant technology to separate and purify the individual rare earth elements. Briefly describe the three basic steps involved in solvent extraction process. **[6marks]**
c) Briefly explain two types of classifiers that you know. **[4marks]**
d) Outline the difference between magnetic and electrical separation. **[5marks]**
e) State and describe coal processing technologies after it is mined. **[5marks]**

Question 5 [25 marks]

a) Normally, run-of-mine ore is transported from the mine associated with the harmful materials. What are these materials and why should one remove these harmful materials? **[6marks]**
b) There are different ways of concentrating ores in mineral processing which depends on the properties of the ore. You are required to give the property and an example of the mineral which can be concentrated based on that property. **[5marks]**
c) A slurry stream containing quartz is diverted into a 1-1itre density can. The time taken to fill the can is measured as 9 sec. The pulp density is measured by means of a calibrated balance, and is found to be 1400 kg/m^3. Given the density of quartz is 2650kg/m^3. Calculate:
   i. The % solids by weight,
   ii. Mass flow rate of quartz within the slurry. **[6marks]**
d) What is mineral processing? How is it useful to mining industry? **[4marks]**
e) State the advantages of wet grinding over dry grinding. **[4marks]**

Question 6 [25 marks]

a) Hydrometallurgy and pyro-metallurgy are used in the extraction of metals from ores. You are required to list the unit processes involved in each process and the differences which are used to make a choice between the two. **[9marks]**
b) State the factors that affect the rate of filtration. **[5marks]**
c) Briefly explain what you understand by the term contact angle and its significance in froth flotation. **[5marks]**
d) Explain the following terms:
   i. Thickening **[2marks]**
   ii. Coagulation **[2marks]**

iii. Flocculation **[2marks]**

End of