



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

ORE DRESSING AND EXTRACTION

EMI 2104

Final Examination Paper

January 2021`

Time Allowed: 3 hours
Total Marks: 100
Examiner's Name: Miss N.R Gwati
Authorised material: Calculator

INSTRUCTIONS

1. This paper contains **ONE** section with **FIVE** questions
2. Answer **QUESTION 1** and **any other THREE** questions
3. Each question **carries 25 marks**
4. Where a question contains subdivision, the mark value of each subdivision is shown in brackets
5. Start each question on a new page

Question 1

- a) What measures can a mining engineer take to ensure high recovery in the metallurgical plant. **(5 marks)**
- b) Discuss the ways in which physio-chemical properties of minerals are exploited to separate and concentrate them. **(7 marks)**
- c) Explain the mechanism of froth flotation and discuss the effect of the following variables;
(i) mineral particle size
(ii) residence time. **(8 marks)**
- d) The throughput of a grinding mill is 200tph. If the Bond Work index of the ore is 14.85 kWh/t, what is the power drawn by the crusher in reducing the feed size F80 from 600 mm to a product size P80 of 100 mm. **(5 marks)**

Question 2

- a) Describe the operation of a jaw crusher. Your description should include a clear illustration of the machine and clearly labelled. **(6 marks)**
- b) Under what circumstances would you consider replacing the jaw crusher in your process flowsheet with a gyratory crusher? **(2 marks)**
- c) Describe the method operation in AG/SAG mills **(5 marks)**
- d) With the aid of flow diagrams, explain open circuit grinding and closed circuit grinding and what are the advantages of closed circuit over open circuit. **(7 marks)**
- e) State the advantages of wet grinding over dry grinding and what factors do you consider when selecting between wet and dry grinding **(5 marks)**

Question 3

- a) What is the main purpose of screening and classification in the minerals industry and what do you consider when selecting between classification and screening? **(3marks)**
- b) State and explain the factors affecting screen performance. **(5 marks)**
- c) With the aid of a diagram, explain the mechanism by which fine particles are separated in a hydro cyclone. **(5 marks)**
- d) Filtration is one of the dewatering methods that can be used. Briefly describe the factors that affecting the rate of filtration. **(5 marks)**
- e) A slurry stream containing quartz is diverted into a 1-litre density can. The time taken to fill the can is measured as 8 sec. The pulp density is measured by means of a calibrated balance, and is found to be 1500 kg/m³. Calculate the % solids by weight, and the mass flow rate of quartz within the slurry. **(7 marks)**

Question 4

- a) Feed 0.7%Fe, Conc -30%Fe, Tails – 0.1% Fe.

Given the above information calculate

- i) The recovery of Fe **(2 marks)**
 - ii) The ratio of concentration **(2 marks)**
 - iii) Enrichment ratio **(2 marks)**
- b) With the aid of a flow diagram describe and explain the stages involved in the processing of platinum using mineral processing method. **(10 marks)**
- c) List the advantages and disadvantages of dense medium separation. **(5marks)**
- d) Compare and contrast coagulation and flocculation. **(4 marks)**

Question 5

- a) With the aid of a flow diagram describe and explain the stages involved in the processing of gold using hydrometallurgical processes. **(10 marks)**
- b) Why is residency time and concentration of leachant important factors in leaching? **(4 marks)**
- c) State 4 factors influencing choice of leachant **(2 marks)**
- d) There are 3 different adsorption methods in the processing of gold that one can select from. State and explain each method and what properties should be considered before choosing a method. **(9 marks)**