NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF CIVIL, MINING AND PROCESS ENGINEERING

QUALIFICATION: BACHELOR OF ENGINEERING IN METALLURGY, CHEMICAL ENGINEERING & MINING ENGINEERING	
QUALIFICATION CODE: 08BEMT/08BECE/08BMEG	**LEVEL: 7**
COURSE CODE: MPC711S	**COURSE NAME: MINERAL SEPARATION PROCESSES 314**
SESSION: JUNE 2023	**PAPER: THEORY**
DURATION: 3 HOURS	**MARKS: 100**

FIRST OPPORTUNITY QUESTION PAPER	
EXAMINER(S)	**Dr Clement Kwasi Owusu**
MODERATOR:	**Prof. Godfrey Dzinomwa**

INSTRUCTIONS
1. Answer all questions. 2. Read all the questions carefully before answering. 3. Marks for each question are indicated at the end of each question. 4. Please ensure that your writing is legible, neat and presentable.

PERMISSIBLE MATERIALS

1. Examination paper.
2. Non-programmable calculator

Question 1 *(25 Marks)*

Rosh Pinah ore sample was floated using the Magotteaux laboratory flotation to produce lead and zinc concentrate. The outcome of the laboratory flotation test after assaying is presented in the Table below. Calculate;

i. the recovery of Pb in copper concentrate *(5 marks)*

ii. the recovery of Zn in zinc concentrate *(5 marks)*

iii. the tonnage (tph) of the lead concentrate *(5 marks)*

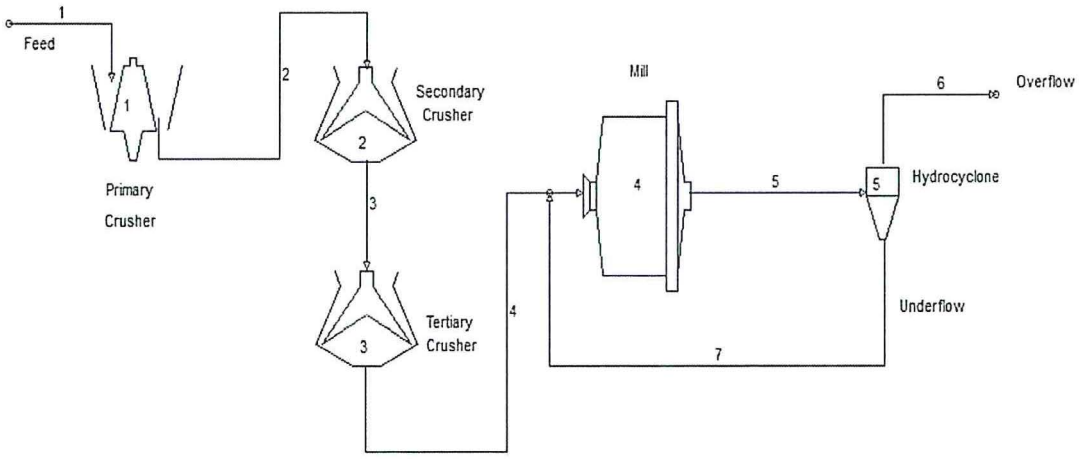
iv. the tonnage (tph) of the zinc concentrate *(5 marks)*

v. the tonnage (tph) tailings *(5 marks)*

Stream	Throughput (tph)	Assay	
		Pb (%)	Zn (%)
Feed	150	5.7	4.3
Pb concentrate	-	50.3	2.1
Zn concentrate	-	0.2	60.7
Tailings	-	0.15	0.10

Question 2 **(20 marks)**

A comminution circuit comprising of three crushers, a mill and hydrocyclone for a gold processing plant is presented in the figure below. Per the plant design, 600 t/h of material at a size of 80% passing 50 mm goes through the primary crushers.



i. If the reduction ratios for the primary, secondary and tertiary crushers are 5, 3.5 and 1.5 respectively, determine the product size for each crusher. *(6 marks)*

ii. What is the mill product size (in microns) if the energy required to grind the 600 t/h of material is 8219.204 kWh and the work index of the ore is 14.8 kWh/t.

(Assume that cyclone underflow has the same size as the tertiary crusher product)? *(10 marks)*

iii. If the circulating load is 25%, estimate the mass for cyclone overflow and underflow. *(4 marks)*

Question 3 **(26 marks)**

a. Briefly explain the impact of the following on screen performance

i. Percentage near mesh particles *(3 marks)*

ii. Moisture content of feed *(3 marks)*

iii. Feed rate *(3 marks)*

b. Mention two areas in minerals processing where hydrocyclones are widely used as a classifier *(4 marks)*

c. Mention two advantages of dense medium separation *(5 marks)*

d. Calculate the mass of water in tonnes required to be added to 48.2 tonnes of ferrosilicon compound to make a slurry of pulp density of 2.92 t/m^3. Assume the density of ferrosilicon compound is 7.0 t/m^3 and that of water is 1 t/m^3. *(8 marks)*

Question 4 **(29 marks)**

a. Explain the terms rougher cell, scavenger cell and cleaner cell as applied in flotation *(9 marks)*

i. A single cell in a given bank of flotation cells gives a Copper recovery of 45% for a residence time of 5 minutes. Find the number of similar sized cells in a continuous flotation bank that would give a total recovery of 93%. *(6 marks)*

b. Explain the subaqueous deposition method as applied in tailings management. *(4 marks)*

ii. Mention 3 possible causes for tailings dam failure. *(6 marks)*

c. Explain the relevance of gravity take-up pulley in conveyor belt system *(4 marks)*

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)