UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: **MR 474**
COURSE NAME: **METALLURGICAL PLANT DESIGN AND CONTROL**
CLASS: **MR IV** TIME: **3HRS**

Name**:** _____Index Number: _____

ANSWER ALL QUESTIONS

Q1.

a. What is plant design? **[4 marks]**

b. Briefly discuss the major components of plant and flow sheet design. **[6 marks]**

c. Discuss the significance of bench and pilot scale data acquisition in metallurgical plant design. **[6 marks]**

d. Can a company policy such as depreciation method has an effect on investment on a metallurgical plant design and operation? Discuss **[4 marks]**

Q2.

Using the information provided in **Tables 1 – 3**, design a diaphragm wet discharge ball mill to grind **100 t/h** gold ore (**S.G. 2.7**) with a work index of **15 kWh/t** from a feed size of **80% passing 6.35 mm** to a product size of **80% passing 0.149 mm**. Your design should clearly shows all the calculations required to estimate the dimensions of the mill as well as the maximum ball size. Recommend an appropriate circuit type for this ore based on the annual production rate. Assume a mill of **44 – 45%** charge loading. Take **k** to be **200**. [**20 marks**].

Q3.

a. Explain the Kynch's mathematical model. **[3 marks]**

b. How did Talmage and Fitch applied Kynch's mathematical model to the problem of thickener design? **[3 marks]**

c. A thickener is to be installed to receive cyclone overflow of density, **30%** solids and thicken it to **55%** solids. In a day, the plant is expected to treat **25,000 t** of ore at **4%** moisture, and sedimentation test has resulted in a settling rate of **750 mm/min**.

i. Estimate the area of the thickener **[3 marks]**

ii. What is the expected diameter? **[2 marks]**

d. If lateritic material with very bad settling characteristics are encountered, and the settling rate changes to **300 mm/min**,

i. Estimate the new thickener area and diameter **[3 marks]**

ii. Determine the feed rate if the same thickener area is to be maintained **[1 mark]**

iii. Comment on the thickening of materials with different settling properties.

[5 marks]

A – Factor for diameter inside the shell liners (Table 1)

Diameter inside shell liners, m	Factor A
3.200	63.5
3.505	79.3
3.810	97.5
4.115	118.5

C – Factor for mill speed expressed as a percentage of critical speed (Table 2)

Percentage critical speed	Factor C
68	0.1585
72	0.1724
76	0.1878

B – Factor for mill type and charge volume loading. B = 5.77 for mills filled to 44 – 45% of mill volume.

L – Length of grinding chamber (cylindrical section) liners, in meters (Table 3)

Net diameter, m	Critical speed					
	68%		72%		76%	
	L	L/D	L	L/D	L	L/D
3.200	7.326	2.29	6.727	2.10	6.175	1.93
3.505	5.866	1.67	5.386	1.54	4.945	1.41
3.810	4.771	1.25	4.381	1.15	4.022	1.06
4.115	3.926	0.95	3.605	0.88	3.309	0.08

Dr E.A. Agorhom*/Assoc Prof G. Ofori-Sarpong*