Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Mineral Resources and Technology Degree Programme
1st Semester Examination – March/April 2013

Uva Wellassa University

MRT 462-3 Industrial Mineral Processing Technology

Number of questions: Five (05)
Answer **all** questions
Time allocation: Three (03) hours
Total marks: 500

1.

a.

i. Briefly discuss primary and secondary dust collectors with the aid of a diagram. (40 marks)

ii. Discuss the advantages of dust collectors except for enhancing the quality of air in mineral processing industry. (10 marks)

iii. Briefly discuss how to mitigate (reduce) dust and noise effect in a crusher plant. (10 marks)

b.

i. Drive a formula for falling dust gravity with the aid of diagram. (If you made any reasonable assumption please indicate.) (20 marks)

ii. Calculate time ratio considering 5 and 20 microns size dust particles using above equation. (20 marks)

2.

a.

i. Briefly explain what "froth flotation" used in mineral processing industry. (15 marks)

ii. Cumulative recovery is given by $R = RI(1 - e^{-kt})$
where,
R is the cumulative recovery after time t;
k is the first order rate constant (time-l);
t is the cumulative flotation time;
RI is the maximum theoretical flotation recovery.

How would you calculate rate of maximum theoretical flotation recovery? (15 marks)

iii. Results of a flotation kinetics test carried out on a bitumen sample aare given below

Flotation time (Minutes)	Bitumen Recovery (%)
1	70
12	95

Assuming that the flotation rate (k) is a first order equation,

I. Determine the parameters of RI and k.

(15 marks)

II. Determine the flotation time required to achieve 80% recovery.

(10 marks)

b. Design a flotation circuit to recover graphite from sand with following system circuits. Discuss advantage and disadvantages of each.

(15×3=45 marks)

i. Simple cleaner system.

ii. Rougher-scavenger-cleaner system.

iii. Rougher-scavenger-cleaner-recleaner system.

3.

a. Briefly discuss the importance of sampling methods in mineral processing industry

(20 marks)

b. Compare and contrast Gy's and Gaudin's calculation methods.

(30 marks)

c. Calculate representative sample size from whole quantity.

(50 marks)

Bulk Material Parameters:

Same material as for the previous example
$CuFeS_2$, 1.5% cu (4.3318% $CuFeS_2$): Top Size 1.5cm;
Desired sample acuuracy : +/- 0.02% Cu (+/- 0.0578% $CuFeS_2$)
$CuFeS_2$ specific gravity = 4.2; Overall specific gravity: 2.8;
A = 1.5 cm
ρ_s = 2.8 gm/cm^3

4.

a. Explain, Recovery and Mass balance using equations (10 marks)

b. Using formulas discuss sensitivity of
   i. Recovery equation. (20 marks)
   ii. Mass balance equation. (20 marks)

c. Laboratory hydro-cyclone is fed with a slurry of quartz (density 2670 kg/m^3) at a pulp density of 1150 kg/ m^3. The under flow has a pulp density of 1260 kg/m^3 and the over flow 1060kg/m^3. A 2.2 liter sample of under flow was taken after 4.4s. Calculate the mass flow rate of the feed to the cyclone. (50 marks)

5. Briefly explain any **four** of the following.
   Use sketches where necessary

   a. Gravity separation methods.
   b. High tension separator.
   c. Sri Lankan mineral and available processing industries.
   d. Hydro cyclone
   e. Value addition of Sri Lankan minerals

(25×4=50 marks)

56

Annex
Sample Calculation using Gaudung Method

Basic Equations:

$$n = 0.45\frac{x}{y^2}$$

$$n' = \frac{6}{\rho_s a^3}$$

$$S = \frac{n}{n'}$$

where:

x = volume fraction occupied by the species of interest
y = variation in volume fraction that would correspond to the maximum allowable error
n = number of particles that will be needed in the final sample
n'= estimated number of particles per gram
p_s= density of the bulk sample, in grams/cm3
a = top size of the material being sampled, in cm
S = total sample weight needed, in grams.