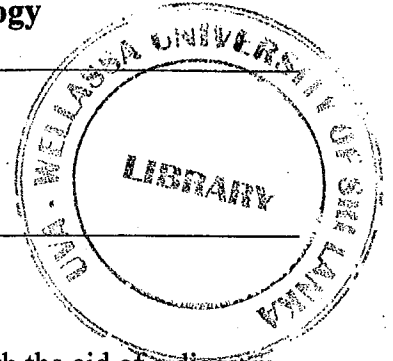


Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Mineral Resources and Technology Degree Programme
1st Semester Examination – March/April 2013



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. Derive 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⁻¹);
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 are 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

CuFeS₂, 1.5% Cu (4.3318% CuFeS₂): Top Size 1.5cm;

Desired sample accuracy : +/- 0.02% Cu (+/- 0.0578% CuFeS₂)

CuFeS₂ specific gravity = 4.2; Overall specific gravity: 2.8;

A = 1.5 cm

$\rho_s = 2.8 \text{ gm/cm}^3$

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 1060 kg/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)

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

ρ_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.