Uva Wellassa University, Sri Lanka
End Semester Examination – March 2012

MRT 361-2 Mineral Processing Methods

Duration: Two (02) hours

Uva Wellassa University

Total five (05) questions
Answer **four (04)** questions only

1. (a) What are the advantages of screens? (15 marks)

(b) Given below are the results of a sieve analysis of a sand.

Size(microns)	Weight (g)
+450	50
-450,+325	42
-325,+225	32
-225,+180	52
-180,+125	22
-125,+90	32

Amount of loss= 10g

Using the log-log graph paper provided,
(i) Plot the cumulative weight percent passing against the particle size in microns. (30 marks)
(ii) From the plot, determine the mass median size (50% passing) in microns. (10 marks)
(iii) Determine the estimated percentage of material in the -90, +52 microns fraction. (10 marks)

(c) Derive a formula for screening efficiency. (35 marks)

2. (a) Derive Stoke's Law to determine particle settling time. (20 marks)

(b) Using Stoke's equation, calculate the diameter of a coal particle (S.G.=1.4) which would settle in water at the same velocity as a 30 micron diameter quartz particle (S.G.=2.65) settling in water.

Viscosity of slurry =1.012 x 10^{-3} PaS, S.G. of slurry = 1.3 acceleration due to gravity =9.8 m/S^2

(30 marks)

(c) Repeat the calculation in above (b) for both particles in air. (30 marks)
Density of air at 25 °C is 0.001205 g·cm^{-3}

(d) Explain a method to separate beach sand. (20 marks)

3. Following is a description of the grinding circuit of a uranium mill.

The grinding circuit consists of a 4.42 m diam. by 2.0 m long SAG mill in open circuit with a single size screen. Screen oversize reports to a 2.7 m diam. by 3.0 m long ball mill. The ball mill operates in closed circuit with two sizing screens. The undersize from all three screens reports to the neutral thickener. The thickened slurry is pumped at a nominal density of 50% solids to four air-agitated storage pachucas in leaching. The average feed rate is 65 t per operating hour. The product size is about 80% passaing 300 μm and 45% passing 75 μm. The work index of the ore is 23.7 kW-hr/t.

(a) Sketch a flow sheet of the above grinding circuit. (50 marks)

(b) If electrical power is available at 20 cents/kW-hr, using Bond's equation estimate the power cost (in $/24-hr day) required for comminution of the ore. List the assumptions made in your calculation.

Bond's equation:

$$W = \frac{10W_i}{\sqrt{P}} - \frac{10W_i}{\sqrt{F}}$$

(30 marks)

(c) Using a grinding ball size of 1.0 m, calculate the percent critical speed if the SAG mill rotates at 13 rpm. Sketch a flow sheet of the above grinding circuit. (20 marks)

$$Critical\ speed\ N_c = \frac{42.3}{(D-d)^{0.5}}\ rev/min$$

4. (a) What is communition? Briefly discuss related instruments with aid of diagrams. (60 marks)

(b) Briefly explain;
(i) principles of gravity concentration (20 marks)
(ii) sinking table mechanism (20 marks)

5. With the aid of sketches describe the operating principles and application of the following mineral processing unit operations.
(a) Rod mill
(b) Jig
(c) Floatation column
(d) Spiral (Humphreys)
(e) Gyratory crusher

(20x5 marks)