NTK/KW/15 – 7823

Fourth Semester B. Tech. (Chem. Engg.) (CBS) Examination

MECHANICAL OPERATIONS

Time : Three Hours] [Max. Marks : 80

N. B. : (1) All questions carry equal marks.
(2) Answer any **five** questions.
(3) Assume suitable data wherever necessary.

1. (a) A crusher is reducing limestone of crushing strength 70 MN/m^2 from 16 mm diameter size to product size of 0.6 mm diameter requires 9 kw. The same machine is used to crush dolomite at the same rate of output from 16 mm diameter size to product which consists of 20% with an average diameter of 0.25 mm, 60% with an average diameter of 0.125 mm and the balance having an average diameter of 0.085 mm. Estimate the power required to drive the crusher, assuming that the crushing strength of dolomite is 100 MN/m^2 and that crushing follow's Rittinger's law. 8

(b) What are the different motions of screens ? Explain with neat sketches. 8

2. (a) Write notes on :—

(i) Chain and flight conveyor.

(ii) Screw conveyor. 8

(b) Derive expression for power requirement of belt conveyor in detail. 8

3. (a) Discuss construction and working of flotation machine. 8

(b) Discuss construction and working of electrostatic precipitator. 8

4. (a) Derive an expression for filtration at constant rate and at constant pressure. 8

(b) Write short notes on :—

(i) Sand filter.

(ii) Plate and frame filter press. 8

5. (a) A slurry containing 3.5 kg and water/kg of solids is to be thickened to a sludge containing 0.75 kg of water/kg of solids in a continuous operation. Laboratory test using five different conc. of slurry yielded the following results.

Conc (kg water/ kg of solids)	3.5	2.8	2.3	1.7	1.1
Rate of sedim-entation	0.20	0.12	0.094	0.070	0.05

Calculate minimum area of thickner to effect separation of 0.5 kg/s of solids. 8

(b) Explain Kynch theory of sedimentation. 8

6. Explain in detail (any **two**) :—

(i) Ribbon mixer.

(ii) Internal screw mixer.

(iii) Tumbling mixer. 16

7. (a) What are three categories of classifiers ? Explain working of cone classifier. 8

(b) Calculate the settling velocity for hindered settling of glass sphere in water at 20^0C when suspension contains 1206 gm of glass spheres in 1200 cm^3 of total volume the average diameter of the sphere was 0.15 mm and the density of sphere is 2400 kg/m^3. 8

8. Explain in detail any **two** :—

(i) Cyclone separator.

(ii) Dense phase pneumatic conveyor.

(iii) Dilute phase pneumatic conveyor. 16