

B.Tech-4th(Chemical)
Process & Handling of Materials

Full Marks: 70

Time: 3 hours

Answer SIX questions including Q No. 1 which is compulsory.
The figures in the right hand margin indicate marks.

Q1. Answer all questions. [2×10]

1. a) What do you mean by choke and free feeding ?
- b) Why more power is required to grind finer particles rather than coarser particles?
- c) How does the specific surface change in size reduction ?
- d) Why crushing efficiencies are low in size reduction equipments?
- e) Why cumulative analysis is preferred over differential analysis??
- f) What do you mean by constant volume and constant pressure filtration?
- g) What is the main factor causing separation in froth floatation process?
- h) What is critical speed in a ball mill and explain its significance ?
- i) Explain the difference between mixing and agitation?
- j) Differentiate between compressible and incompressible cakes.

Q2. Derive in detail the equations for constant pressure filtration and constant volume filtration. [10]

Q3. a) Explain cascading, cataracting and centrifuging action in a ball mill with neat labeled diagram. [5]

b) Explain with neat labeled diagrams the unit operations used for liquid-solid separations. [5]

Q4.a) Explain different types of size reduction equipment's used in ultrafine grinding. [5]

b) What are bins, silos and hoppers? What are the factors to be considered for the design of bins, silos and hoppers. [2+3]

Q5. a) 2 tonnes of galena is to be reduced to fine powder by passing through a crusher and a grinder in succession, drawing power from the same drive. Screen analysis of feed, product from the crusher, and product from the grinder indicated surface areas of 3, 114 and 900 m²/kg respectively. If the power required by the drive to run the crusher-grinder assembly is 18 kW and efficiency of the crusher is 25 %, find the efficiency of the grinder. Rittinger's number of galena = 95.7 m²/kg [5]

b) Derive in detail the power consumption required for size reduction considering mechanical losses. [5]

Q6. a) What is jigging acceleration? Explain the difference between jigging and classification. [2+3]

b) Compute the maximum velocity at which particles of silica 0.05 mm in diameter (specific gravity= 2.65) will fall through a still water that fills a 50 mm glass diameter if $\mu_f = 10^{-3}$ kg/m-s.

(i) the slurry is so dilute that free settling prevails.

(ii) the mass ratio of water to silica is 2.0 and hindered settling prevails. Assume the particles to be essentially spherical. [5]

Q7.a) (i) What are the various factors which effect power consumption in mixing and agitation.

(ii) Using dimensional analysis show the relationship between power number and other dimensionless groups. [2+3]

b) A slug forming a uniform non-compressible cake is filtered through a filter press. At a constant pressure difference of 2.8 kg/cm^2 , a 10 cm cake is formed in 1 hour with a filtrate volume of 6000 litres. 3 minutes are needed to drain the liquor from filter. 2 minutes are needed to fill the filter with water. Washing proceeds exactly as filtration using 1200 litres. Opening, dumping and closing takes place in 6 minutes. Assume the filtrate has the same properties of wash water & neglect the resistance offered by the cloth. How many litres of filtrate are produced in 24 hours? [5]

Q8. Write short notes on :- [2.5x4]

- a) Grizzly Screens.
- b) Electrostatic separations.
- c) Derivation of angle of nip.
- d) Angle of repose.