

(b) Write a short notes on tangential flow filtration.

9 + 3 = 12

9. Name different types of filters used in industry. What is the function of filter aids? Derive an equation for pressure drop in case of incompressible filter cakes. How you determine the filter cake resistance and filter medium resistance for constant pressure filtration?

(3 + 2 + 3 + 4) = 12

**PARTICLE & FLUID PARTICLE PROCESSING  
(CHEN 2101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Fick's law relates to  
 (a) energy consumption (b) final particle size  
 (c) feed size (d) product size.
- (ii) The main size reduction operation in ultrafine grinders is  
 (a) cutting (b) attrition  
 (c) compression (d) impact.
- (iii) Separation of materials into products based on the difference of their sizes is called  
 (a) sizing (b) sorting  
 (c) classification (d) flocculation.
- (iv) The most accurate law for estimating the power is \_\_\_\_\_.  
 (a) Rittingers law (b) Bond's law  
 (c) Kick's law (d) Power law
- (v) Diatomaceous earth is a  
 (a) Filter aid (b) Catalyst  
 (c) Filter media (d) Collector.
- (vi) In the Newton's Law region terminal velocity of particle is proportional to  
 (a) Square root of particle diameter (b) Particle diameter  
 (c) Square of particle diameter (d) Cube root of particle diameter.
- (vii) On which of the following,  $K_b$  depends?  
 (a) Type of machine and material (b) Type of power  
 (c) Type of operation (d) Type of law.
- (viii) Short distance transportation of grain, gravel, sand, ash, asphalt etc. is done by using a \_\_\_\_\_ conveyor.  
 (a) flight (b) slat or drag (c) ribbon (d) screw

- (ix) Equivalent diameter of a particle is the diameter of the sphere having the same  
 (a) ratio of surface to volume as the actual volume  
 (b) ratio of volume to surface as the particle  
 (c) volume as the particle  
 (d) none of these.
- (x) Which of the following works at the principle of compression?  
 (a) Knife cutter (b) Blake jaw crusher  
 (c) Gyratory Crusher (d) Rod mill.

**Group - B**

2. (a) Define Indian standard screen and BSS. Distinguish between capacity and efficiency of a screen. Describe the relation between feed rate and screen efficiency.  
 (b) Describe the properties affected by the particle size.
3. Following is the results of screen analysis of pyrite having specific gravity as 6 and density is 3000 kg/m<sup>3</sup>. Determine (i) specific surface area (ii) number of particles if all particles are of spherical shape (iii) quadratic mean diameter and (iv) sauter diameter.

Mesh no.	Screen openings, μm	Mass retaining (g)
4	4760	0
6	3353	30
8	2399	46
10	2032	50
14	1405	78
20	842	87
28	708	70
35	500	60
48	296	46
65	211	35
100	151	22
150	104	14
200	75	12

Data given:

Specific surface area of the mixture of particles,  $S_m = \frac{6}{\rho} \sum_{i=1}^f \left( \frac{n_i x_i}{d_{average,i}} \right)$

The specific surface ratio,  $n_i = 0.004057$

Quadratic mean diameter,  $d_q = \left[ \frac{\sum_{i=1}^f \frac{x_i}{d_{average,i}}}{\sum_{i=1}^f \frac{x_i}{d_{average,i}^3}} \right]$

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**Group - C**

4. (a) Define comminution. Describe the different laws of comminution. What is the limitation of Kick's law and Rittinrger's law?  
 (b) Write a short notes on solid particles storage and handling.
5. (a) Write the working principle of a fluid energy mill. Define concepts of nipping and angle of nip.  
 (b) Describe the working principle of ball mill with net schematic diagram.

**Group - D**

6. (a) Define Stokes Law in laminar flow. Describe the working principle of continuous thickener with a net schematic diagram.  
 (b) Define free settling, hindered settling, and sedimentation. Write the difference between Thickening and Clarification.
7. (a) Describe the typical power curve for agitator impellers. Describe the working principle of gravity settling classifier with net schematic diagram.  
 (b) When agitation is required? What selection criteria should be followed for the agitator selection?

**Group - E**

8. (a) A flat-blade turbine with six blades is installed centrally in a vertical tank. The tank is 1.83 m in diameter; the turbine is 0.61 m in diameter and is positioned 0.61 m from the bottom of the tank. The turbine blades are 127 mm wide. The tank is filled to a depth of 1.83 m with a solution of 50% caustic soda at 65.6°C, which has a viscosity of 12 cP and a density of 1498 kg/m<sup>3</sup>. The turbine is operated at 90 rpm. What power will be required to operate the mixer if the tank was baffled?