3 Hours/100 Marks   Seat No.

Instructions : (1) **All** questions are **compulsory**.
(2) Answer **each** next main question on a **new** page.
(3) Illustrate your answers with neat sketches **wherever** necessary.
(4) Figures to the **right** indicate **full** marks.
(5) Assume suitable data, if **necessary**.
(6) Use of Non-programmable Electronic Pocket Calculator is **permissible**.

MARKS

1. A) Attempt **any six** of the following :   **12**

    a) State industrial importance of size reduction equipment.

    b) State Bond's law.

    c) Define mesh number.

    d) Draw the graphical representation of ideal and real screen.

    e) Define homogeneous mixture.

    f) List any two names of chemical industries, where unit operation are carried out.

    g) List any two methods for separating solids from solid-liquid mixture.

    h) List the methods of avoiding vortex formation.

   B) Answer **any two** of the following :   **8**

    a) With neat sketch, explain principle and construction of ball mill.

    b) Classify size reduction equipments based on size of particle.

    c) A quartz mixture is screened through a 10 mesh screen. The cumulative mass fraction of feed, overflow and underflow are $x_F = 0.47$, $x_D = 0.85$ and $x_B = 0.195$ respectively. Calculate the mass ratios of overflow to feed and underflow to feed.

2. Answer **any four** of the following : **16**

   a) A feed of gypsum with 80% of material passing through a 50 mm screen is crushed to a product with 80% product passing through a 5 mm screen. If power required for crushing is 80 kW. What is the capacity of the crushing unit ? W_i of gypsum $= 6.73\ \mathrm{KWH/TON}$.

   b) List out any two industrial importance of vibrating screen and draw a well labelled diagram.

   c) With neat sketch, explain construction and application of grizzlies.

   d) State the laws of classification. Name any four equipments used for classification.

   e) Explain froth flotation operation with neat labelled diagram.

   f) Differential between constant rate filtration and constant pressure filtration (any four points).

3. Answer **any four** of the following : **16**

   a) Explain working of hammer mill.

   b) Explain the effect of following variables on the performance of screen :
      i) Method of feeding
      ii) Slope of the screening surface
      iii) Number of screening surface
      iv) Amplitude and frequency of vibration

   c) Define tramp iron. With neat sketch explain construction and working of magnetic head pulley tramp iron separator.

   d) Explain the difference between constant rate filtration and constant pressure filtration (any four points).

   e) Draw the neat sketch of Basket centrifuge. Give one application of centrifuge.

   f) Explain construction and working principle of vacuum drum filter.

4. Answer **any four** of the following : 16

   a) Derive an expression for effectiveness of screen.

   b) Explain the working principle of electrostatic separator with neat diagram.

   c) Explain the effect of following factors on the rate of filtration :
      i) Viscosity of filtrate   ii) Area of filter
      iii) Porosity of cake   vi) Pressure drop across filter

   d) Draw the neat sketch showing pressure distribution across the cake and filter medium.

   e) Discuss the concept of terminal settling velocity in sedimentation.

   f) Define free settling and lindered settling with one example of each.

5. Answer **any two** of the following : 16

   a) Find the critical speed of ball mill from following data :

   Diameter of ball mill = 600 mm

   Diameter of ball = 40 mm

   Operating speed of ball mill is 40% of critical speed.

   b) Define jigging. Draw the sketch showing upward and downward stroke in hydraulic jig. State its industrial application.

   c) A batch sedimentation test was carried out to understand settling characteristics. The result in terms of height of interface and time are mentioned below.

Height of Interface (cm)	50	40	30	10
Time (s)	0	25	65	205

   Draw the graph of concentration at various height with time. Initial concentration is $20 \dfrac{g}{l}$. Calculate settling velocity.

6. Answer **any four** of the following : **16**

    a) Define filter aid. Give two methods of using filter aid.

    b) Explain the concept of axial flow and radial flow impeller with one examples of each.

    c) State the necessity of mixing in process industries.

    d) With neat sketch, explain working of ribbon blender.

    e) Explain working principle of Sigmed mixer.

    f) Give any four industrial applications of muller mixer.

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