

**MECHANICAL OPERATION
(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) 200 mesh screen is the basis for
 - (a) BSS Screen
 - (b) Tyler screen
 - (c) IS screen
 - (d) None of these
 - (ii) The value of sphericity for a cube is
 - (a) 2
 - (b) 1
 - (c) 1.75
 - (d) 0.65
 - (iii) Fluid energy mill is a
 - (a) Crusher
 - (b) Grinder
 - (c) Ultrafine grinder
 - (d) None of these
 - (iv) Angle of nip is inherent with
 - (a) Toothed roll crushers
 - (b) Impactors
 - (c) Smooth roll crushers
 - (d) None of these
 - (v) Which equipment is the most energy-efficient among the following?
 - (a) Jaw crusher
 - (b) Ball Mill
 - (c) Fluid energy Mill
 - (d) Hammer Mill
 - (vi) Sedimentor is called clarifier when the desired product is
 - (a) Concentrated sludge
 - (b) Suspended slurry
 - (c) Clear liquid
 - (d) Both a and b
 - (vii) Which is used as a collector?
 - (a) Alum
 - (b) petroleum
 - (c) Xanthates
 - (d) copper sulphate

- (viii) For uniform sphere ε varies from
(a) 0.1 to 10 (b) 1 to 100
(c) 0.5 to 0.95 (d) none of these
- (ix) In Newton law region terminal settling velocity u_t varies with
(a) $D_p^{0.5}$ (b) D_p^2
(c) D_p^3 (d) D_p^5
- (x) An example of a hydraulic classifier is
(a) Cyclone separator (b) Colloid mill
(c) Screw mixer (d) Elutriator

Group – B

2. (a) With a neat diagram describe the operation of a compound trommel.
(b) Differentiate between differential and cumulative screen analysis. Which one is more preferable and why?

6 + 3 + 3 = 12

3. (a) For transportation of abrasive materials which type of conveyor is preferable? Explain the action of a screw conveyor with a neat diagram.
(b) Explain the working principle of a dense phase vacuum pneumatic conveying system with a neat diagram. What types of materials are generally transported by this system?

(1 + 5) + (2 + 4) = 12

Group – C

4. (a) What are the four possible actions through which size reduction can be achieved? Define work index.
(b) A material is crushed in a jaw crusher and the average size of the particle is reduced from 20 cm to 5 cm with consumption of energy 2.64×10^4 J/kg. What will be the consumption of energy to crush the same material from 12 cm to 1 cm, assuming a) Rittinger's law b) Kick's law?

(4 + 2) + 6 = 12

5. (a) In a ball mill of 2500 mm diameter, 200 mm steel balls are being used for crushing. Presently the mill is run at 25 rpm. At what speed will the mill have to run if 200 mm balls are replaced by 100 mm balls, all other conditions remaining same?
(b) Derive Kick's law and Bond's law from the generalized crushing law.

6 + 6 = 12

Group – D

6. (a) The terminal settling velocity of a 6 mm diameter glass sphere (density = 2500 kg/m³) in a viscous Newtonian liquid (density = 1500 kg/m³) is 100 μ m/s. If the particle Reynolds number is small and the value of acceleration due to gravity 9.81 m/s², what is the viscosity of the liquid?
- (b) Analyze the differences between free settling and hindered settling. How can you determine the settling velocity for a suspension in which hindered settling is taking place?

6 + (3 + 3) = 12

7. (a) An aqueous slurry containing 1.2 percent by weight of solid (specific gravity = 2.0) is to be clarified by continuous sedimentation. Feed to the thickener is 3600 m³ per day and the underflow from the unit analyses 8% solid. A batch sedimentation test on the feed material gave the following information:

Time (min)	0	5	10	20	40	60	180	240	α
Height of interface (cm)	31	21	10	3.2	2.2	2.1	2.0	1.96	1.94

Determine the rate of sedimentation at 30 minutes and the sedimentation constant.

- (b) What are the functions of agitation in industry? Differentiate between propellers, paddles and turbines on the basis of their flow patterns.

6 + (3 + 3) = 12**Group – E**

8. Write short notes on (any of 4) **(4 × 3) = 12**
- (i) Compressible filter cake
 - (ii) Filter medium resistance
 - (iii) Gravity settling tank
 - (iv) Froth floatation
 - (v) Filter media
 - (vi) Filter aids
9. (a) With a diagram, show how cake filters, clarifying filters and cross-flow filters work.
- (b) Describe the working principle of rotary drum filters.

6 + 6 = 12

Department & Section	Submission Link
CHE	https://classroom.google.com/c/Mjk1OTgwNzAyNDk5/a/Mjk1OTgwNzAyNTUx/details