### PARTICLES & 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 <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

## Group – A (Multiple Choice Type Questions)

Choose the correct alternative for the following:  $10 \times 1 = 10$ 1. (i) The main size reduction operation in ultrafine grinders is (a) cutting (b) attrition (c) compression (d) impact (ii) On which of the following, K<sub>b</sub> depends? (a) Type of machine and material (b) Type of power (c) Type of operation (d) Type of law Gizzlies are used for separating \_\_\_\_\_\_ solids. (iii) (b) fine (a) coarse (d) micro (c) any size (iv)The unloading time depends upon the \_\_\_\_ (b) Radial (a) Torque (c) Axial (d) Longitudinal Separation of materials into products based on the difference of their sizes is (v) called (a) sizing (b) sorting (d) flocculation (c) classification In the Newton's Law region terminal velocity of particle is proportional to (vi) (a) Square root of particle diameter (b) Particle diameter (c) Square of particle diameter (d) Cube root of particle diameter The most accurate law for estimating the power is \_\_\_\_\_ (vii) (a) Rittingers law (b) Bond's law (c) Kick's law (d) Power law

What does the below equation represents? (viii)

 $\frac{P}{m} = \frac{K_b}{\sqrt{D_p}}$ 

- (a) Bond's law
- (c) Rittingers law
- (b) Kick's law
- (d) Camp law
- Which of the following works principle of compression? (ix) (a) Knife cutter (b) Blake jaw crusher
  - (c) Gyratory Crusher

- (d) Rod mill
- (x) The gross energy requirement is called as \_ (a) Work index
  - (c) Energy index

- (b) Power index
- (d) Final index

# **Group - B**

Compute the effectiveness of 10 mesh screen if average is the desired product. 2. (a)

Mesh	Particle	<b>Cumulative fraction</b>		
	diameter	Feed	Overflow	Under
	(D <sub>p</sub> ), mm			flow
4	4.669	1	1	1
6	3.327	0.95	0.91	1
8	2.362	0.88	0.67	1
10	1.651	0.50	0.18	0.81
14	1.168	0.25	0.03	0.45
20	0.833	0.10	0.01	0.20
28	0.589	0.07	0	0.11
35	0.417	0.04	0	0.05
65	0.208	0.02	0	0.03

<sup>[(</sup>CO1) (Evaluate/HOCQ)]

- (b) Define angle of Nip. Distinguish between capacity and efficiency of a screen. [(CO1) (Understand/LOCO)]
- Describe the relation between feed rate and screen efficiency. Define shape (c) factor. [(CO1) (Analyze/IOCQ)]

6 + 3 + 3 = 12

- 3. Discuss the operating principle of pneumatic and hydraulic conveyors. (a) [(CO1) (Remember/LOCO)]
  - Describe the working principle of Trommels screen and Banana screen. (b) [(CO2) (Understand/LOCQ)]
  - Define flight conveyor stating its importance to handle solid particles. (c) [(CO2) (Analyse/IOCQ)]

4 + 4 + 4 = 12

## Group - C

- 4. Write a short notes on the following: [(CO1, CO2) (Remember/IOCQ)]
  - (i) Kick"s law
  - (ii) Rittinger's law
  - (iii) Bond's law

(4 + 4 + 4) = 12

- 5. (a) Describe the working principle of gyratory crusher and cone crusher. [(CO4) (Understand/LOCQ)]
  - (b) Write the name of different type of crushers for the size reduction. [(CO2) (Remember/IOCQ)]
  - (c) What is the power required to crush 150 ton/h of limestone if 85% of the feed passes in a 2 inch screen and 85% of product in a 1/8 inch screen?
    [(C01) (Analyze/HOCQ)]

4 + 4 + 4 = 12

## Group – D

- 6. Describe the working principle of following classifier. [(CO4) (Understand/IOCQ)]
  - (i) Double cone classifier
  - (ii) Spiral classifier
  - (iii) Bowl classifier.

(4+4+4) = 12

- 7. (a) Describe the working principle of Spitzkasten classifier. [(CO4) (Remember/IOCQ)]
  - (b) What is the important of Cyclone separator? State the working principle of Cyclone Separator. [(CO4) (Understand/LOCQ)]
  - (c) Define the forth flotation. State the working principle of flotation process. [(CO4) (Analyze/HOCQ)]

4 + 4 + 4 = 12

# Group - E

- 8. (a) Write the name of different types of centrifugal separation equipments. [(CO4) (Remember/LOCQ)]
  - (b) Describe the working principle of cyclone separator with net schematic diagram. [(CO5) (Understand/LOCQ)]
  - (c) Describe the different types of nanomaterial synthesis methods in a block diagram. [(CO4) (Understand/IOCQ)]

4 + 4 + 4 = 12

9. (a) Write the important properties of nanomaterial. Define band-gap. Write the different types of nanomaterial. [(CO3) (Remember/LOCQ)]

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- (b) State the working principle of Plate and frame filter. [(CO3, CO4) (Understand/LOCQ)]
- (c) Write the importance of optical and magnetic properties of nanomaterial. [(CO4) (Understand/HOCQ)]

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	78.12	15.63	6.25

#### Course Outcome (CO):

After the completion of the course students will be able to

- 1. Calculate average particle diameters for a mixture of solid particles and select different screens according to specifications.
- 2. Select the type of crusher/grinder for a particular comminution operation and calculate the energy consumption.
- 3. Calculate drag force and terminal settling velocity for single particles.
- 4. Select the type of classifier required for a given operation and given a particular thickening operation, design the thickener required.
- 5. Calculate power consumption for an agitation operation and scale up the agitator as per the problem given.
- 6. Analyze filtration data and select filtration equipment based on requirements.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
CHE	https://classroom.google.com/c/NDA2NzcyMDk4MDU1/a/NDc0ODQ3NTM3Mzcz/details