PARTICLES & FLUID PARTICLE PROCESSING
(CHE2101)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Fick's law relates to
(a) Energy consumption (b) final particle size
(c) feed size (d) product size

(ii) For any non-spherical particle, Sphericity is defined as _____
(a) 6Vp/DpPs (b) 6Vp/PsSp
(c) Vp/DpSp (d) 6Vp/DpSp

(iii) The most accurate law for estimating the power is ____
(a) Rittingers law (b) Bond's law
(c) Kick's law (d) Power law

(iv) The gross energy requirement is called as ____
(a) Work index (b) Power index
(c) Energy index (d) Final index

(v) Which of the following works principle of compression?
(a) Knife cutter (b) Blake jaw crusher
(c) Gyratory Crusher (d) Rod mill

(vi) What is the type of flow called when the particle Reynolds number is less than 1?
(a) Couette flow (b) Creeping flow
(c) Vortex flow (d) Poiseuille flow

(vii) Ore concentration by jigging is based on the difference in the _____ of the particles.
(a) Specific gravities (b) Wet ability
(c) Shape (d) Size

(viii) Which factor does NOT affect particle motion in a fluid?
(a) Fluid viscosity (b) Particle density
(c) Surface characteristics (d) Atomic number

(ix) Separation of materials into products based on the difference of their sizes is called
(a) Sizing (b) Sorting (c) Classification (d) Flocculation

(x) Which of the following can be used for separation of pulp?
(a) Liquid cyclone (b) Cone classifiers
(c) Drag classifier (d) Elutriator

Fill in the blanks with the correct word

(xi) Shape factor of spherical particle is _____.

(xii) A fluid energy mill is used for _____.

(xiii) Centrifuge and automatic discharges are used for _____.

(xiv) A compressible cake has the _____ porosity at the upstream side.

(xv) Bond's law introduces the concept of _____.

Group - B

2. (a) What is screen analysis, and how is it used to determine particle size distribution in particulate solids? *[(CO1)(Analyse/HOCQ)]*
(b) State the advantages and limitations of using screen analysis for particle size determination. *[(CO1)(Remember/LOCQ)]*
(c) State the name of the various types of industrial screen equipment for the solid particles. *[(CO1)(Apply/IOCQ)]*

3 + 6 + 3 = 12

3. (a) Describe the difference between ISS and BSS. *[(CO1)(Apply/IOCQ)]*
(d) Following the results of screen analysis of pyrite having specific gravity 7. Assume that all the particles are of spherical shape. Find the mass specific surface area using following formula.

$S_m = \frac{6}{\rho}\sum_{i=1}^{f}(\frac{n_i x_i}{d_{avg,i}})$

Mesh number	Screen opening (μm)	Mass retaining (g)	Specific surface ration (n)
4	4760	0	-
6	2353	30	5.2
8	2399	46	4.7
10	2032	50	4.2
14	1405	78	3.8
20	842	87	3.4
25	708	70	3
35	500	60	2.8
50	296	46	2.6
70	211	35	2.3
100	151	22	2.2
140	104	14	2.1
200	75	12	2

[(CO1)(Apply/IOCQ)]

3 + 9 = 12

Group - C

4. (a) Explain laws of comminution and its importance. *[(CO2)(Analyse/HOCQ)]*
   (b) Explain Rittinger's Law of Comminution, including its assumptions and limitations. *[(CO2)(Remember/LOCQ)]*

4 + 8 = 12

5. (a) Describe the size reduction principle and operation of attrition mill. *[(CO2)(Analyse/HOCQ)]*
   (b) Explain the working principle of hammer mill and attrition fluid energy mill. *[(CO2)(Remember/LOCQ)]*

4 + 8 = 12

Group - D

6. (a) A particle of diameter 5 mm is settling through a liquid of density 1000 kg/m^3 and viscosity 1 cP. In a separate settling experiment, it was found that a 0.2 kg sample of the particle displaced 0.00013 m^3 of liquid. Determine the terminal settling velocity of the 5 mm particle. *[(CO3)(Evaluate/HOCQ)]*
   (b) Explain the working principle of a Hirate thickener. *[(CO3)(Remember/LOCQ)]*

8 + 4 = 12

7. (a) State the significance of Ergun and Kozeny Carman equations. *[(CO3)(Analyse/HOCQ)]*
   (b) Explain the Darcy's law and its applications. *[(CO3)(Remember/LOCQ)]*

4 + 8 = 12

Group - E

8. (a) State the working principle of Bag filter. *[(CO4)(Analyse/LOCQ)]*
   (b) Describe the working principle of electrostatic precipitator with a neat schematic diagram. *[(CO4)(Apply/IOCQ)]*

6 + 6 = 12

9. (a) Deduce the expression of pressure drop (ΔP) through filter cake and cake resistance (α). *[(CO3)(Analyse/HOCQ)]*
   (b) Describe the design equation of filtration. *[(CO4)(Remember/LOCQ)]*

8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	45.83	21.88	32.29