Code No: 07A40803   **R07**   **Set No. 2**

II B.Tech II Semester Examinations,December 2010
MECHANICAL UNIT OPERATIONS
Chemical Engineering

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. Write a note on the following:

   (a) Cross flow filtration

   (b) Washing of filter cakes.   [8+8]

2. (a) Define/explain the following terms:

   i. crystal
   ii. magma
   iii. mother liquor
   iv. eutectic mixture

   (b) Do crystals always form spontaneously in a supersaturated solution? Discuss.
   [8+8]

3. Crushed galena from a ball mill has the following screen analysis:

Mesh no.	D_{pi}, mm	Mass fraction, X_i
28	0.589	0.000
35	0.417	0.150
48	0.295	0.200
65	0.208	0.171
100	0.177	0.134
150	0.104	0.104
200	0.074	0.080
Pan	-	0.161

   (a) Present the information in the form of a histogram.

   (b) Determine the average particle diameter based on weight

   (c) Determine the total surface area of a 100 g sample of the crushed ore. Φ_s=0.5
   and specific gravity of galena = 7.43.   [6+4+6]

4. Write about:

   (a) Gas dispersion in agitated vessels

   (b) Equipment for dispersion of liquids in liquids.   [8+8]

5. (a) Describe the construction and working of a gyratory crusher with a neat
   sketch.

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(b) In crushing a certain ore, the feed is such that 80% is less than 5.08 cm (2 in) in size and the product is such that 80% is less than 0.635 cm (1/4 in). The power required is 89.5 kW (12 hp). What will be the power required using the same feed so that 80% is less than 0.3175 cm (1/8 in)? Use Bond's crushing law equation.

[8+8]

6. (a) Describe the construction and operation of the top-suspended basket centrifuge with a neat diagram.

(b) Write about the construction and working of a horizontal belt filter with a neat diagram. [8+8]

7. Write about

(a) Feeding and discharge methods of a belt conveyor

(b) Width and speed of belt

(c) Weight of belt. [8+4+4]

8. (a) What are the basic principles of centrifugal sedimentation? Show the particle trajectory in a sedimenting centrifuge and derive the equation for volumetric qc based on the cut point diameter.

(b) Describe the working of tubular centrifuge? [8+8]

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Code No: 07A40803 **R07** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
MECHANICAL UNIT OPERATIONS
Chemical Engineering

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain contact nucleation.

   (b) State and explain ΔLlaw? Write relevant equations. [8+8]

2. Write short notes on:

   (a) Hammer mills and impactors

   (b) Rolling compression machines

   (c) Attrition mills. [6+4+6]

3. Derive an expression to calculate specific cake resistance, starting from the first principles. [16]

4. Give a detailed account of the following equipment used for transportation of solids:

   (a) Screw conveyors

   (b) Elevators. [8+8]

5. Write the distinguishing features of the following:

   (a) angle of internal friction and angle of repose

   (b) differential and cumulative analysis of particle sizes

   (c) mixers for dry powders and mixers for pastes in general. [6+5+5]

6. (a) What are different flow patterns in mixing and how are they obtained?

   (b) Explain the importance of baffles in agitation. [8+8]

7. (a) Write about the construction and working of a horizontal belt filter with a neat diagram.

   (b) Write in detail about automatic batch centrifuges . [8+8]

8. (a) Explain differential settling method for separation of particles of different densities.

   (b) Quartz and pyrites are to be separated in a hydraulic free settling classifier. The feed to the classifier ranges in size between 10 microns and 300 microns. The specific gravity of quartz is 2.65 and that of pyrites is 5.1. If the mixture is best separated into three fractions such as one containing only quartz, another containing only pyrites and the third a mixture of quartz and pyrites, estimate the size ranges of these ranges of the two materials in these fractions. Assume the flow zone to be essentially laminar. [8+8]

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Code No: 07A40803

R07

Set No. 4

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FIRSTRANKER

Code No: 07A40803   **R07**   **Set No. 1**

II B.Tech II Semester Examinations,December 2010
MECHANICAL UNIT OPERATIONS
Chemical Engineering

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Give a detailed account of tumbling mills.

   (b) Describe the action in ball mills and obtain an expression for the critical speed of a ball mill. [8+8]

2. Discuss the salient features and working of the following:

   (a) Apron conveyors

   (b) Pneumatic conveyors

   (c) Bucket elevators

   (d) Screw conveyors. [4+4+4+4]

3. (a) Write short notes on:
      i. Mixing rolls
      ii. Muller mixers
      iii. Pug mills.

   (b) Discuss about the power requirements in mixing of solids and pastes. [4+4+4+4]

4. (a) Define invariant crystal. How in the concept of invariant growth useful in analyzing the crystallization process?

   (b) Define purity of a crystal.

   (c) Explain calculation of yield for a crystallization process.

   [16]

5. Differentiate between:

   (a) Constant-pressure filtration and constant-rate filtration

   (b) Cake filtration and crossflow filtration

   (c) Ultra filtration and micro filtration

   (d) Specific cake resistance and filter medium resistance. [16]

6. Write about industrial purposes of suspension of solids. Also discuss different conditions of suspension. [16]

7. Write about continuous vacuum filters in detail with schematic diagrams. [16]

8. (a) What are differential settling classifiers? Discuss briefly.

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(b) In a mixture of quartz and galena, the size of the particles ranges from 0.0002 cm to 0.001 cm. On separation in a hydraulic classifier using water under free settling conditions, what are the size ranges of quartz and galena in pure products? Assume the flow zone to be essentially laminar.   [16]

Specific gravity of quartz = 2.65

Specific gravity of galena = 7.5

Viscosity of water = 0.001 kg/m-s

Density of water = 1000 kg/m^3

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Code No: 07A40803   **R07**   **Set No. 3**

II B.Tech II Semester Examinations,December 2010
MECHANICAL UNIT OPERATIONS
Chemical Engineering

Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What are the factors considered for analyzing crystallization? Explain briefly.

   (b) Discuss the significance of crystal size.

   (c) State and explain the dimensions used to measure the size of an invariant crystal.

   [16]

2. (a) Sketch a typical agitation equipment and discuss their dimension with respect to a tank diameter.

   (b) Explain dispersion of gas in liquids and power required. [8+8]

3. (a) Discuss in detail about the action in tumbling mills and obtain the expression for the critical speed of a ball mill.

   (b) What rotational speed, in revolutions per minute, would you recommend for a ball mill 1200 mm in diameter charged with 75 mm balls? [8+8]

4. Give a detailed description about the following elements of belt conveyors:

   (a) Belt construction

   (b) Drives

   (c) Supports

   (d) Take-ups. [4+4+4+4]

5. Obtain a general relation between thickness of cake and volume of filtrate. Discuss the same for :

   (a) Filtration at constant rate

   (b) Filtration at constant pressure. [8+8]

6. (a) Explain how cohesive solids flow out of bins.

   (b) The discharge opening for flow of solids out of bins plays an important role in maintaining a proper control of the flow rate. Explain.

   (c) What causes the solids to arch or bridge in the container and prevent flow? How is it overcome? [6+4+6]

7. (a) Differentiate between an ideal screen and actual screen. State the reasons for deviation from ideality.

   (b) Write about capacity and effectiveness of screens.

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(c) One ton per hour of dolomite is produced by crushing and then screening through 14-mesh screen. According to the screen analysis below, calculate

   i. the total load to the crusher and

   ii. effectiveness of the screen.　　　　　　　　　　　　　　　　　　[4+4+8]

Taylor mesh	Feed to screen, %	Under size, %	Over size, %
+ 4	14.3	–	20
+8	20.0	–	28
+14	20.0	0	28
+28	28.5	40.0	24
+48	8.6	30.0	(0 through 28 mesh)
+100	5.7	20.0	
-100	2.86	10.0	

8. The data given below were obtained from a single batch sedimentation test on an ore slurry. The density of the solids in the slurry was 2.5 g/cm^3, and the density of the liquid was 1.00 g/cm^3. Determine the area required for a thickener to handle 100 tons of solids per day from a feed concentration of 64.5 g/liter to an underflow concentration of 485 g/liter.

[16]

Concentration,(g/ liter of slurry)	64.5	70.9	94.3	111.7	139.9	173.9	222	331
Settling rate,(cm/hr)	139.9	103.3	71.9	49.4	27.1	16.8	10.0	6.4

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