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

II B.Tech II Semester Examinations,APRIL 2011
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 advantages of size reduction and what is an ideal crusher?
   (b) Give a detailed account of the three laws of crushing. State their limitations. [6+10]

2. (a) Derive the expression for the overall effectiveness of a screen, starting from simple material balance.
   (b) A quartz mixture having the screen analysis shown in the table below is screened through a standard 10-mesh screen. The cumulative screen analysis of overflow and underflow are given in the table. Calculate the mass ratios of the overflow and underflow to feed and the overall effectiveness of the screen. [8+8]

Cumulative fraction smaller than D_p

Mesh	D_p, mm	Feed	Overflow	Underflow
4	4.699	0	0	
6	3.327	0.025	0.071	
8	2.362	0.150	0.43	0
10	1.651	0.47	0.85	0.195
14	1.168	0.73	0.97	0.58
20	0.833	0.885	0.99	0.83
28	0.589	0.94	1.00	0.91
35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.00		1.00

3. Give a detailed account of belt conveyors. [16]

4. A plate and frame filter press, filtering a slurry, gave a total of 8 m3 of filtrate in 1800 seconds and 11 m^3 in 3600 s, when filtration was stopped. Estimate the washing time in seconds if m3of wash water are used. The resistance of the cloth can be neglected and a constant pressure is used throughout. . [16]

5. Write about:
   (a) Explain the variations of circulation velocities and power consumption in mixing of liquids.

(b) Estimate the power required for a propeller mixer of propeller diameter 30 cm. The liquid being mixed has a density of 1.75 g/cc and viscosity is 1.6 cP, at the operating NRe=29,000, given the value of power group is 0.22. [8+8]

6. (a) Give an account of the characterization of solid particles.

(b) The screen analysis shown below applies to a sample of crushed quartz. The density of the particles is 2650 kg/m^3 and the shape factors are: a = 2 and $\Phi_s = 0.571$. For the material between 4 mesh and 200 mesh in particle size calculate $\overline{D}_s$ and $\overline{D}_w$ [8+8]

Mesh no.	D_{pi}, mm	Mass fraction, X_i	Mesh no.	D_{pi}, mm	Mass fraction, X_i
4	4.699	0.0000	35	0.417	0.9616
6	3.327	0.0251	48	0.295	0.9718
8	2.362	0.1501	65	0.208	0.9795
10	1.651	0.4787	100	0.147	0.9853
14	1.168	0.7278	150	0.104	0.9894
20	0.833	0.8868	200	0.074	0.9925
28	0.589	0.9406	Pan	—	1.0000

7. (a) Explain the working of MAT with a neat sketch.

(b) What is the capacity in m3/hr of a clarifying centrifuge operating with the given conditions: Dia of bowl = 600 mm Depth of bowl = 400 mm Thickness of liquid layer = 75 mm Speed = 400 rpm Viscosity of liquid = 2 cP Cutsize of particles = 30 m Specific gravity of liquid and solid are 1.2 and 1.6 respectively. [8+8]

8. Write short notes on:

(a) Crystallographic systems

(b) Principles of crystallization

(c) Crystal growth [8+8]

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

II B.Tech II Semester Examinations,APRIL 2011
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 about:
   (a) Explain the variations of circulation velocities and power consumption in mixing of liquids.
   (b) Estimate the power required for a propeller mixer of propeller diameter 30 cm. The liquid being mixed has a density of 1.75 g/cc and viscosity is 1.6 cP, at the operating NRe=29,000, given the value of power group is 0.22. [8+8]
2. Give a detailed account of belt conveyors. [16]
3. A plate and frame filter press, filtering a slurry, gave a total of 8 m3 of filtrate in 1800 seconds and 11 m^3 in 3600 s, when filtration was stopped. Estimate the washing time in seconds if m3of wash water are used. The resistance of the cloth can be neglected and a constant pressure is used throughout. . [16]
4. Write short notes on:
   (a) Crystallographic systems
   (b) Principles of crystallization
   (c) Crystal growth [8+8]
5. (a) Give an account of the characterization of solid particles.
   (b) The screen analysis shown below applies to a sample of crushed quartz. The density of the particles is 2650 kg/m^3 and the shape factors are: a = 2 and $\Phi_s = 0.571$. For the material between 4 mesh and 200 mesh in particle size calculate $\overline{D}_s$ and $\overline{D}_w$ [8+8]

Mesh no.	D_{pi}, mm	Mass fraction, X_i	Mesh no.	D_{pi}, mm	Mass fraction, X_i
4	4.699	0.0000	35	0.417	0.9616
6	3.327	0.0251	48	0.295	0.9718
8	2.362	0.1501	65	0.208	0.9795
10	1.651	0.4787	100	0.147	0.9853
14	1.168	0.7278	150	0.104	0.9894
20	0.833	0.8868	200	0.074	0.9925
28	0.589	0.9406	Pan	—	1.0000

6. (a) What are the advantages of size reduction and what is an ideal crusher?
   (b) Give a detailed account of the three laws of crushing. State their limitations. [6+10]

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

7. (a) Derive the expression for the overall effectiveness of a screen, starting from simple material balance.

   (b) A quartz mixture having the screen analysis shown in the table below is screened through a standard 10-mesh screen. The cumulative screen analysis of overflow and underflow are given in the table. Calculate the mass ratios of the overflow and underflow to feed and the overall effectiveness of the screen.

[8+8]

Mesh	D_p, mm	Cumulative fraction smaller than D_p Feed	Overflow	Underflow
4	4.699	0	0	
6	3.327	0.025	0.071	
8	2.362	0.150	0.43	0
10	1.651	0.47	0.85	0.195
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65	0.208	0.98		0.975
Pan		1.00		1.00

8. (a) Explain the working of MAT with a neat sketch.

   (b) What is the capacity in m^3/hr of a clarifying centrifuge operating with the given conditions: Dia of bowl = 600 mm Depth of bowl = 400 mm Thickness of liquid layer = 75 mm Speed = 400 rpm Viscosity of liquid = 2 cP Cutsize of particles = 30 m Specific gravity of liquid and solid are 1.2 and 1.6 respectively. [8+8]

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

II B.Tech II Semester Examinations,APRIL 2011
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 plate and frame filter press, filtering a slurry, gave a total of 8 m3 of filtrate in 1800 seconds and 11 m^3 in 3600 s, when filtration was stopped. Estimate the washing time in seconds if m3 of wash water are used. The resistance of the cloth can be neglected and a constant pressure is used throughout. . [16]

2. (a) Give an account of the characterization of solid particles.

   (b) The screen analysis shown below applies to a sample of crushed quartz. The density of the particles is 2650 kg/m^3 and the shape factors are: a = 2 and $\Phi_s = 0.571$. For the material between 4 mesh and 200 mesh in particle size calculate $\overline{D}_s$ and $\overline{D}_w$ [8+8]

Mesh no.	D_{pi}, mm	Mass fraction, X_i	Mesh no.	D_{pi}, mm	Mass fraction, X_i
4	4.699	0.0000	35	0.417	0.9616
6	3.327	0.0251	48	0.295	0.9718
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14	1.168	0.7278	150	0.104	0.9894
20	0.833	0.8868	200	0.074	0.9925
28	0.589	0.9406	Pan	—	1.0000

3. (a) Derive the expression for the overall effectiveness of a screen, starting from simple material balance.

   (b) A quartz mixture having the screen analysis shown in the table below is screened through a standard 10-mesh screen. The cumulative screen analysis of overflow and underflow are given in the table. Calculate the mass ratios of the overflow and underflow to feed and the overall effectiveness of the screen.

   [8+8]

	Cumulative fraction smaller than D_p

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

Mesh	D_p, mm	Feed	Overflow	Underflow
4	4.699	0	0	
6	3.327	0.025	0.071	
8	2.362	0.150	0.43	0
10	1.651	0.47	0.85	0.195
14	1.168	0.73	0.97	0.58
20	0.833	0.885	0.99	0.83
28	0.589	0.94	1.00	0.91
35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.00		1.00

4. Write about:

   (a) Explain the variations of circulation velocities and power consumption in mixing of liquids.

   (b) Estimate the power required for a propeller mixer of propeller diameter 30 cm. The liquid being mixed has a density of 1.75 g/cc and viscosity is 1.6 cP, at the operating NRe=29,000, given the value of power group is 0.22. [8+8]

5. (a) Explain the working of MAT with a neat sketch.

   (b) What is the capacity in m3/hr of a clarifying centrifuge operating with the given conditions: Dia of bowl = 600 mm Depth of bowl = 400 mm Thickness of liquid layer = 75 mm Speed = 400 rpm Viscosity of liquid = 2 cP Cutsize of particles = 30 m Specific gravity of liquid and solid are 1.2 and 1.6 respectively. [8+8]

6. (a) What are the advantages of size reduction and what is an ideal crusher?

   (b) Give a detailed account of the three laws of crushing. State their limitations. [6+10]

7. Write short notes on:

   (a) Crystallographic systems

   (b) Principles of crystallization

   (c) Crystal growth [8+8]

8. Give a detailed account of belt conveyors. [16]

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

II B.Tech II Semester Examinations,APRIL 2011
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) Derive the expression for the overall effectiveness of a screen, starting from simple material balance.

   (b) A quartz mixture having the screen analysis shown in the table below is screened through a standard 10-mesh screen. The cumulative screen analysis of overflow and underflow are given in the table. Calculate the mass ratios of the overflow and underflow to feed and the overall effectiveness of the screen. [8+8]

Mesh	D_p, mm	Cumulative fraction smaller than D_p		
		Feed	Overflow	Underflow
4	4.699	0	0	
6	3.327	0.025	0.071	
8	2.362	0.150	0.43	0
10	1.651	0.47	0.85	0.195
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35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.00		1.00

2. (a) What are the advantages of size reduction and what is an ideal crusher?

   (b) Give a detailed account of the three laws of crushing. State their limitations. [6+10]

3. A plate and frame filter press, filtering a slurry, gave a total of 8 m3 of filtrate in 1800 seconds and 11 m^3 in 3600 s, when filtration was stopped. Estimate the washing time in seconds if m3of wash water are used. The resistance of the cloth can be neglected and a constant pressure is used throughout. . [16]

4. (a) Explain the working of MAT with a neat sketch.

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

5. Write about:

   (a) Explain the variations of circulation velocities and power consumption in mixing of liquids.

   (b) Estimate the power required for a propeller mixer of propeller diameter 30 cm. The liquid being mixed has a density of 1.75 g/cc and viscosity is 1.6 cP, at the operating NRe=29,000, given the value of power group is 0.22. [8+8]

6. Give a detailed account of belt conveyors. [16]

7. (a) Give an account of the characterization of solid particles.

   (b) The screen analysis shown below applies to a sample of crushed quartz. The density of the particles is 2650 kg/m^3 and the shape factors are: a = 2 and $\Phi_s = 0.571$. For the material between 4 mesh and 200 mesh in particle size calculate $\overline{D}_s$ and $\overline{D}_w$ [8+8]

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8. Write short notes on:

   (a) Crystallographic systems

   (b) Principles of crystallization

   (c) Crystal growth [8+8]

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