BITS PILANI - DUBAI CAMPUS

Dubai International Academic City, Dubai, U.A.E.

III Year Chemical Engineering, II Semester 2011-12

Course Code: CHE C431 **COMPREHENSIVE EXAM** Date: 10.06.13

Course Title: Selected Chemical Engineering Operations Max Marks: 70

Duration: 3 hr (Closed Book) Weightage: 35%

Note: Attempt ALL questions. Draw a labeled flow diagram wherever necessary, mentioning therein all the known and unknown variables. Write all assumptions and steps clearly.

1.(a) An experiment was carried out in SCHEO lab using a crushing mill. The following sieve analysis was obtained. Plot the differential (% retained on sieve) and cumulative analysis (show the percent passing curve only). (5+5 = 10 m)

Mesh number	Mesh Aperture (microns)	Mass retained (g)
6	3350	0
8	2360	8.8
12	1700	21.3
16	1180	138.2
20	850	211.6
30	600	161.7
40	425	81.6
50	300	44.1
70	212	28.7
140	106	13.2
170	90	9.6
230	63	8.8
Pan	~	5.2

1(b). Discuss briefly about heat removal and energy consumption for size reduction operations. (4 m)

2(a). Discuss in-detail about mechanisms of filtration. (4 m)

2(b). Discuss in-detail about any centrifugal filter with its working principle, advantages and limitations. (4 m)

2(c). Mention the significance of submergence percentage of the drum of a rotary filter in the slurry. (3 m)

3(a). Lewis, Gilliland, Chertow, and Hoffman measured adsorption equilibria for pure propane, pure propylene, and binary mixtures thereof, on activated carbon and silica gel. Adsorbate capacity was high on carbon, but selectivity was poor. Selectivity was high on silica gel, but capacity was low. For silica gel (751 m^2/g), the following pure component data were obtained at 25°C: Fit the pure component data to Freundlich and Langmuir isotherms. Which gives the best fit? Which component is most strongly adsorbed? (10+2+2 = 14 m)

Propane		Propylene	
P, Torr	W, mmol/g	P, Torr	W, mmol/g
11.1	0.0564	34.2	0.3738
25	0.1254	71.4	0.7227
43.5	0.198	91.6	0.7472
71.4	0.2986	194.3	1.129
100	0.385	198.3	1.168
158.9	0.5441	271.5	1.401
227.5	0.702	353.2	1.562
304.2	0.843	550.7	1.918
387	1.01	555.2	1.928
468	1.138	760.6	2.184
569	1.288		
677.8	1.434		
775	1.562		

3(b) Discuss briefly about solution diffusion mechanism of the polymer membranes. (3 m)

4(a). The data obtained on the drying rates of a certain solid are given below.

X kg water/kg dry air	0.35	0.2	0.18	0.16	0.14	0.12	0.1	0.09	0.08	0.07	0.05
N kg/h m^2	1.5	1.5	1.33	1.19	1.04	0.9	0.75	0.48	0.35	0.21	0.05

Calculate the time required to dry the cake from 30% moisture to 5% moisture in batch drier if the surface available for drying is 1 m^2/35 kg of dry solid and if the drying is to be carried out under still air conditions. (8 m)

4(b). A wet solid is dried from 40 to 8 percent moisture in 20 Ks. If the critical and the equilibrium moisture contents are 15 and 4 percent respectively, how long will it take to dry the solid to 5 percent moisture under the same drying conditions? All moisture contents are on a dry basis. (4 m)

4(c). Given an industrial example for the following dryers: (4 m)

(i) Adiabatic counter air-heated rotary drier

(ii) Continuous fluid-bed dryers

(iii) Agitated thin film dryers

(iv) Double drum dryers

5(a) Discuss in detail about temperature difference as a potential for supersaturation crystallization. (4 m)

5(b). Mention the methods to produce supersatuation solution for crystallization. (3 m)

5(c). Discuss in detail about an industrial crystallizer with its working principle, advantages and its limitations. (5 m)

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(Answering Scheme)

Note: Attempt ALL questions. Draw a labeled flow diagram wherever necessary, mentioning therein all the known and unknown variables. Write all assumptions and steps clearly.

1.(a) An experiment was carried out in SCHEO lab using a crushing mill. The following sieve analysis was obtained. Plot the differential (% retained on sieve) and cumulative analysis (show the percent passing curve only). (5+5 = 10 m)

Mesh number	Mesh Aperture (microns)	Mass retained (g)
6	3350	0
8	2360	8.8
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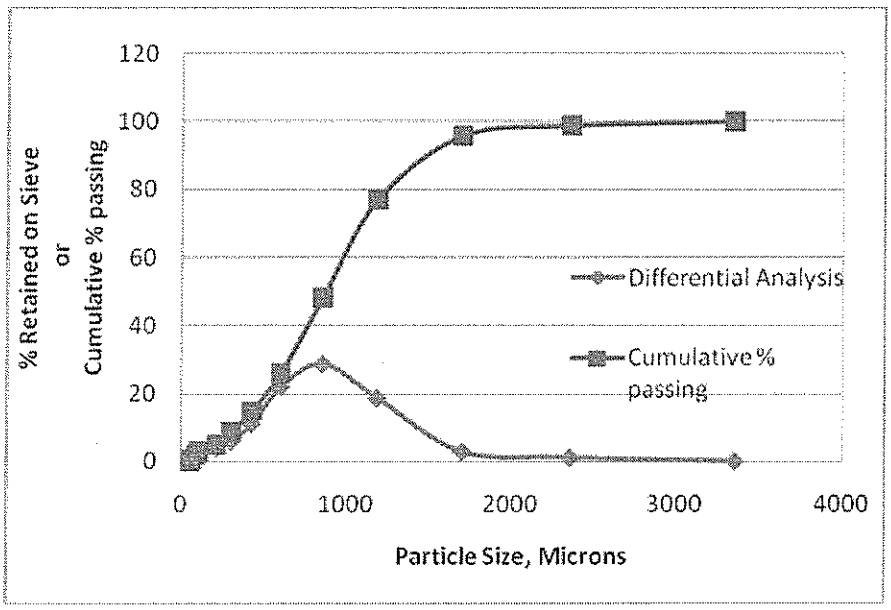
30	600	161.7
40	425	81.6
50	300	44.1
70	212	28.7
140	106	13.2
170	90	9.6
230	63	8.8
Pan	~	5.2

Mesh number	Mesh Aperture (microns)	Mass retained [g]	Avg. aperture	Retained %	Passed %	Cuml% passing
6	3350	0	-	0	0	100
8	2360	8.8	2855	1.200873362	1.200873362	98.79912664
12	1700	21.3	2030	2.906659389	4.107532751	95.89246725
16	1180	138.2	1440	18.85917031	22.96670306	77.03329694
20	850	211.6	1015	28.87554	51.84224	48.157751

				585	891	09
30	600	161.7	725	22.06604803	73.90829694	26.09170306
40	425	81.6	512.5	11.13537118	85.04366812	14.95633188
50	300	44.1	362.5	6.0180131	91.06168122	8.938318777
70	212	28.7	256	3.916484716	94.97816594	5.021834061
140	106	13.2	159	1.801310044	96.77947598	3.220524017
170	90	9.6	98	1.310043668	98.08951965	1.910480349
230	63	8.8	76.5	1.200873362	99.29039301	0.709606987
Pan	~ 53	5.2	58	0.709606987	100	0
		732.8		100		

Differential			Cummulative analysis	
X axis	y axis		X axis	y axis
particle size	% retained on sieve		particle size	Cumulative % passing
3350	0		3350	100
2360	1.200873362		2360	98.79912664
1700	2.906659389		1700	95.89246725
1180	18.85917031		1180	77.03329694
850	28.87554585		850	48.15775109
600	22.06604803		600	26.09170306
425	11.13537118		425	14.95633188
300	6.0180131		300	8.938318777
212	3.916484716		212	5.021834061
106	1.801310044		106	3.220524017
90	1.310043668		90	1.910480349
63	1.200873362		63	0.709606987
53	0.709606987		53	0



Differential analysis (using avg screen sizes), Cumulative % passing (using actual screen sizes)

1(b). Discuss briefly about heat removal and energy consumption for size reduction operations. (4 m)

Refer class notes.

2(a). Discuss in-detail about mechanisms of filtration. (4 m)

Cake filter, clarifying filter, cross flow filter

2(b). Discuss in-detail about any centrifugal filter with its working principle, advantages and limitations. (4 m)

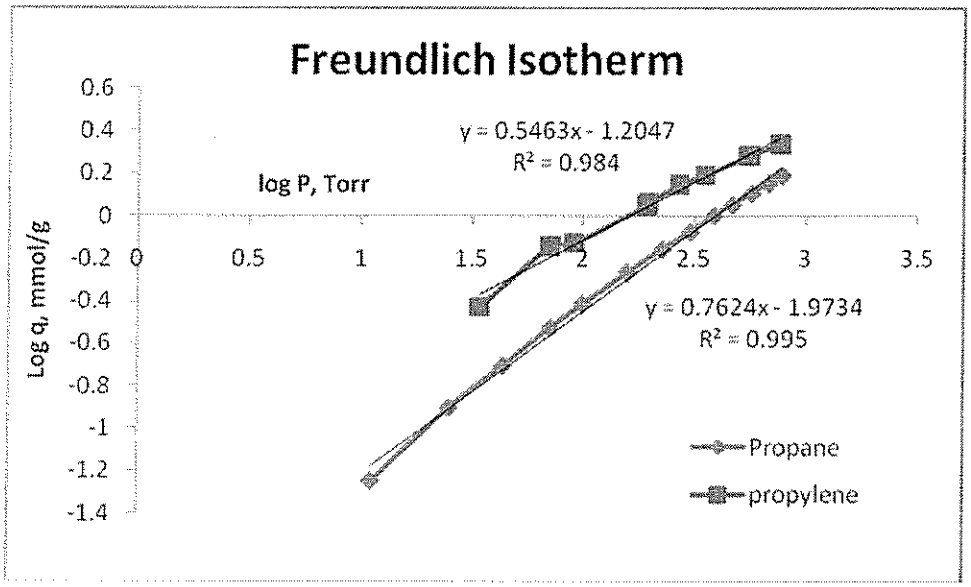
Refer class notes.

2(c). Mention the significance of submergence percentage of the drum of a rotary filter in the slurry. (3 m)

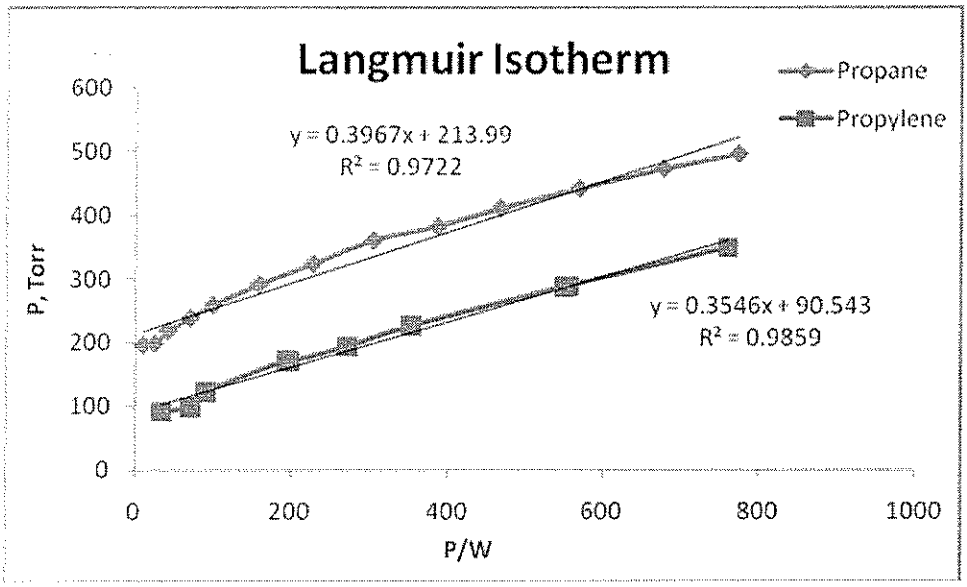
Most bottom feed filters operate with about 30 % of their filter area submerged in the slurry. When high filtering capacity and no washing are desired, a high submergence filter with 60 to 70% of its filter are submerged may be used.

3(a). Lewis, Gilliland, Chertow, and Hoffman measured adsorption equilibria for pure propane, pure propylene, and binary mixtures thereof, on activated carbon and silica gel. Adsorbate capacity was high on carbon, but selectivity was poor. Selectivity was high on silica gel, but capacity was low. For silica gel (751 m^2/g), the following pure component data were obtained at 25°C: Fit the pure component data to Freundlich and Langmuir isotherms. Which gives the best fit? Which component is most strongly adsorbed? (10+2+2 = 14 m)

Propane		Propylene	
P, Torr	W, mmol/g	P, Torr	W, mmol/g
11.1	0.0564	34.2	0.3738
25	0.1254	71.4	0.7227
43.5	0.198	91.6	0.7472
71.4	0.2986	194.3	1.129
100	0.385	198.3	1.168
158.9	0.5441	271.5	1.401
227.5	0.702	353.2	1.562
304.2	0.843	550.7	1.918
387	1.01	555.2	1.928
468	1.138	760.6	2.184
569	1.288		
677.8	1.434		
775	1.562		



	Propane					Propylene		
		y axis	x axis				y axis	x axis
P, Torr	W, mmol/g	log W	log P		P, Torr	W, mmol/g	log W	log P
11.1	0.0564	-1.24872	1.045323		34.2	0.3738	-0.42736	1.534026
25	0.1254	-0.9017	1.39794		71.4	0.7227	-0.14104	1.853698
43.5	0.198	-0.70333	1.638489		91.6	0.7472	-0.12656	1.961895
71.4	0.2986	-0.52491	1.853698		194.3	1.129	0.052694	2.288473
100	0.385	-0.41454	2		198.3	1.168	0.067443	2.297323
158.9	0.5441	-0.26432	2.201124		271.5	1.401	0.146438	2.43377
227.5	0.702	-0.15366	2.356981		353.2	1.562	0.193681	2.548021
304.2	0.843	-0.07417	2.483159		550.7	1.918	0.282849	2.740915
387	1.01	0.004321	2.587711		555.2	1.928	0.285107	2.744449
468	1.138	0.056142	2.670246		760.6	2.184	0.339253	2.881156
569	1.288	0.109916	2.755112					
677.8	1.434	0.156549	2.831102					
775	1.562	0.193681	2.889302					



	Propane					Propylene	Langmuir	
		y axis	x axis				y axis	x axis
P, Torr	W, mmol/g	P/w	P		P, Torr	W, mmol/g	P/w	P
11.1	0.0564	196.8085	11.1		34.2	0.3738	91.49278	34.2
25	0.1254	199.362	25		71.4	0.7227	98.79618	71.4
43.5	0.198	219.697	43.5		91.6	0.7472	122.591	91.6
71.4	0.2986	239.1159	71.4		194.3	1.129	172.0992	194.3
100	0.385	259.7403	100		198.3	1.168	169.7774	198.3
158.9	0.5441	292.0419	158.9		271.5	1.401	193.7901	271.5
227.5	0.702	324.0741	227.5		353.2	1.562	226.1204	353.2
304.2	0.843	360.8541	304.2		550.7	1.918	287.122	550.7
387	1.01	383.1683	387		555.2	1.928	287.9668	555.2
468	1.138	411.2478	468		760.6	2.184	348.2601	760.6
569	1.288	441.7702	569					
677.8	1.434	472.6639	677.8					
775	1.562	496.1588	775					

Freundlich: $\mathbf{W = bP^m}$

Propane : $y = 0.7624x - 1.9734$; $b = 0.0106$; $W = 0.01062\ P^{0.7624}$

Propylene: $y = 0.5463x - 1.2047$; $b = 0.0624$; $W = 0.0624\ P^{0.546}$

Langmuir: $\mathbf{W = [KW_mP]/[1+KP]; P/W = 1/W_mK + P/W_m}$

Propane $y = 0.3967x + 213.99$; $W_m = 2.52$, $K = 0.0018$; $W = [0.0018(2.52)P] / [1+0.0018P]$

Propylene: $y = 0.3546x + 90.543$; $W_m = 2.82$, $K = 0.00391$; $W = [0.00391(2.82)P] / [1+0.00391P]$

From the above results both Freundlich and Langmuir isotherms fits the data. Propylene adsorption capacity was found to be more than propane

3(b) Discuss briefly about solution diffusion mechanism of the polymer membranes. (3 m)

Refer class notes.

4(a). The data obtained on the drying rates of a certain solid are given below.

X kg water/kg dry air	0.35	0.2	0.18	0.16	0.14	0.12	0.1	0.09	0.08	0.07	0.05
N kg/h m^2	1.5	1.5	1.33	1.19	1.04	0.9	0.75	0.48	0.35	0.21	0.05

Calculate the time required to dry the cake from 30% moisture to 5% moisture in batch drier if the surface available for drying is 1 m^2/35 kg of dry solid and if the drying is to be carried out under still air conditions. (8 m)

Sol^n

Draw graph N Vs X from graph N_c = 1.5 kg/m^2 h, X_c = 0.2
X_1 = 0.3/0.7 = 0.4286 kg H_2O/kg dry solid
X_2 = 0.05/0.95 = 0.05263 kg H_2O / kg dry solid
X^* = 0.043 kg H_2O/kg dry solid
t_c = Ls/A Nc (X1-Xc) = 35/1.5 (0.4286-0.2) = 5.334 h
Time for falling rate period 1 = N_1 = 1.5 kg/h m^2, N_2 = 0.75 kg/h m^2
t_{f1} = Ls/A((Xc-X_2)/N_1-N_2) ln(N_1/N_2) = 35 ((0.2-0.1)/(1.5-0.75)) = 3.24 h
t_{f2} = in this period rate curve is not a st. line and time is to be obtained by graphical integration.
For this, value of 1/N are computed and plotted against X to get the integral dx/N;
t_{f2} = 35/1 integral (dx/N)= 35(0.2688) = 9.41 h
Total drying time = 5.33 + 3.24 + 9.41 = **17.98 h**

4(b). A wet solid is dried from 40 to 8 percent moisture in 20 Ks. If the critical and the equilibrium moisture contents are 15 and 4 percent respectively, how long will it take to dry the solid to 5 percent moisture under the same drying conditions? All moisture contents are on a dry basis. (4 m)

For first drying operation:
X1 = 0.4; X2 = 0.08; Xc = 0.15; X* = 0.04
Let x is wt fraction of moisture in solid,
X1 = x1/(1-x1) = 0.538, X2 = 0.1627, X* = 0.1111
t_T = Ms/AR_c { X_1 –X_c + (X_c - X*)ln(X_c/X_2)}

Ms/AR_c = k = 11.29 (after substituting above values)

X_2 = 0.0638

Therefore t_T = 6.56 hr

4(c). Given an industrial example for the following dryers: (4 m)

(i) Adiabatic counter air-heated rotary drier – Fertilizers
(ii) Continuous fluid-bed dryers – food grains, sawdust
(iii) Agitated thin film dryers - pharmaceuticals, bulk drugs
(iv) Double drum dryers - Milk products, baby foods, breakfast cereals, fruit and vegetable pulps

5(a) Discuss in detail about temperature difference as a potential for supersaturation crystallization. (4 m)

Refer class notes

5(b). Mention the methods to produce supersatuation solution for crystallization. (3 m)

- Less soluble at low temperature –supersaturation by cooling
- Independent of temperature.
- For intermediate – combination of cooling and evaporation.

5(c). Discuss in detail about an industrial crystallizer with its working principle, advantages and its limitations. (5 m)

Refer class notes

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Test 2** Date: 08.05.13

Course Title: Selected Chemical Engineering Operations Max Marks: 15

Duration: 50 minutes (Open Book) Weightage: 15%

Note : only prescribed text book and own handwritten notes are allowed, physical and chemical property tables are allowed

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1. Strips of material 10 mm thick are dried under constant drying conditions from 28 to 13 percent moisture in 25 Ks. If the equilibrium moisture content is 7 percent, what is the time (in days) taken to dry 60 mm planks from 22 percent to 10 percent moisture under the same conditions assuming no loss from the edges? All moisture is given in a wet basis. The relation between A, the ratio of the final free moisture content to initial free moisture content, and the parameter B is given by,

A	1	0.64	0.49	0.38	0.295	0.22	0.14
B	0	0.1	0.2	0.3	0.5	0.6	0.7

It may be noted that $B = Kt/L^2$, where K is the constant, t the time in Ks, 2L is the thickness of the sheet of material in mm. (10 marks)

2. A wet solid slab weighing 200 kg with a drying surface of 1 m^2/75 kg is to be dried from 40 to 20% moisture. Drying tests have shown that this drying takes place at constant rate and that the critical moisture of the solid is 20%. The constant drying rate is 3×10^{-2} kg/m^2.min. Calculate drying time in minutes. All moisture is given in a wet basis.

(5 m)

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Test 2** Date: 08.05.13

Course Title: Selected Chemical Engineering Operations Max Marks: 15

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A	1	0.64	0.49	0.38	0.295	0.22	0.14
B	0	0.1	0.2	0.3	0.5	0.6	0.7

It may be noted that $B = Kt/L^2$, where K is the constant, t the time in Ks, 2L is the thickness of the sheet of material in mm. (10 marks)

$X_1 = 28/72 = 0.388$

$X_2 = 13/87 = 0.149$

$X^* = 7/93 = 0.07$

$B = K\ t/L^2$; 2L = thickness, L = 10/2 = 5

A = final free moisture/initial free moisture = (0.149-0.07)/(0.388-0.007) = 0.248

t = 25 Ks = 25000 sec = 25000/60×60 = 6.94 hr

From graph B = 0.6 (Graph A vs B, when A = 0.248); $0.6 = K\ 25/\ (10/2)^2$; K = 0.6.

For the 60 mm planks

$X_1 = 22/78 = 0.28$; X2 = 10/90 = 0.111

A = (0.111-0.07)/(0.28-0.07) = 0.198

From graph , B = 0.65 ; $0.65 = 0.6 \times t\ /(60/2)^2$; t = 975 KS = 11.28 days

2. A wet solid slab weighing 200 kg with a drying surface of 1 m^2/75 kg is to be dried from 40 to 20% moisture. Drying tests have shown that this drying takes place at constant rate and that the critical moisture of the solid is 20%. The constant drying rate is 3×10^{-2} kg/m^2.min. Calculate drying time in minutes. All moisture is given in a wet basis. (5 m)

$t_c = Ls\ (X_1-X_2)/\ A\ Nc$

$Ls/A = 75$ kg/m^2, $Nc = 3 \times 10^{-2}$ kg/m^2.min.

$X_1 = 0.4/0.6 = 0.67$, $X_2 = 0.2/0.8 = 0.25$

$t_c = 75/\ 3 \times 10^{-2}$ kg/m^2.min. (0.67-0.25) = **1050 min**

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Test 1** Date: 21.03.13

Course Title: Selected Chemical Engineering Operations Max Marks: 15

Duration: 50 minutes (Closed Book) Weightage: 15%

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1. Mention the limitations of precoat filters. (1 m)

2. Mention the parameters influences the capacity of any rotary filters. (1 m)

3. Match the following and explain briefly about the operations (3 × 1.5 = 4.5 m)

a) Filter press -	top suspended batch centrifuge
b) Automatic belt filter –	nutsche
c) Discontinuous vacuum filter –	discontinuous pressure filter
	doctor knife
	jammed

4. Match the following and explain briefly about the operations (3 × 1.5 = 4.5 m)

a) Gyrating screens –	decks
b) Grizzlies –	clarifying screens
c) Vibrating screens –	rubber balls
	parallel metal bars
	metal balls

5. Mention some important adjuncts to the size reduction units. (1 m)

6. Determine clear opening for mesh number 5 as per Tyler standard screen series.

Mesh number	clear opening in 'inch'
4	0.185
5	_____

(1 m)

7. Define Bond's law. (1 m)

8. (i) An ultrafine grinder accepts feed particles no longer than _____ (2 × 0.5 = 1 m)

(ii) Flying knives with edge of tempered steel used in _____

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Test 1** Date: 21.03.13

Course Title: Selected Chemical Engineering Operations Max Marks: 15

Duration: 50 minutes (Closed Book) Weightage: 15%

(Answering Scheme)

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1. Mention the limitations of precoat filters. (1 m)
   Precoat filters can be used only where the solids are to be discarded or where their admixture with large amount of filter aid introduces no serious problem.
2. Mention the parameters influences the capacity of any rotary filters. (1 m)
   The capacity of any rotary filter depends strongly on the characteristics of the feed slurry and particularly on the thickness of the cake that may be deposited in practical operation.
3. Match the following and explain briefly about the operations (3 × 1.5 = 4.5 m)
   a) Filter press - jammed
   b) Automatic belt filter – Discontinuous pressure filter
   c) Discontinuous vacuum filter – Nutsche
   For description refer class notes.

4. Match the following and explain briefly about the operations (3 × 1.5 = 4.5 m)
   a) Gyrating screens – Rubber balls
   b) Grizzlies – Parallel metal bars
   c) Vibrating screens – Decks
   For description refer class notes.

5. Mention some important adjuncts to the size reduction units. (1 m)
   Heaters coolers, metal separators, pump and blowers and constant rate feeders

6. Determine clear opening for mesh number 5 as per Tyler standard screen series.

Mesh number	clear opening in 'inch'
4	0.185
5	**0.130 = (0.185 /√2)** (1 m)

7. Define Bond's law. (1 m)
   Bond postulated that the work required to form particles of size Dp from very large feed is proportional to the square root of the surface -to-volume ratio of the product s_p/v_p.
8. (i) An ultrafine grinder accepts feed particles no longer than 6 mm (2 × 0.5 = 1 m)

   (ii) Flying knives with edge of tempered steel used in rotary knife cutters

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Quiz2** Date: 18.04.13

Course Title: Selected Chemical Engineering Operations Max Marks: 07

Duration: 20 minutes (Closed Book) Weightage: 07%

Name: . . . . . ID No: . . . . . Sec / Prog: . . . . . .

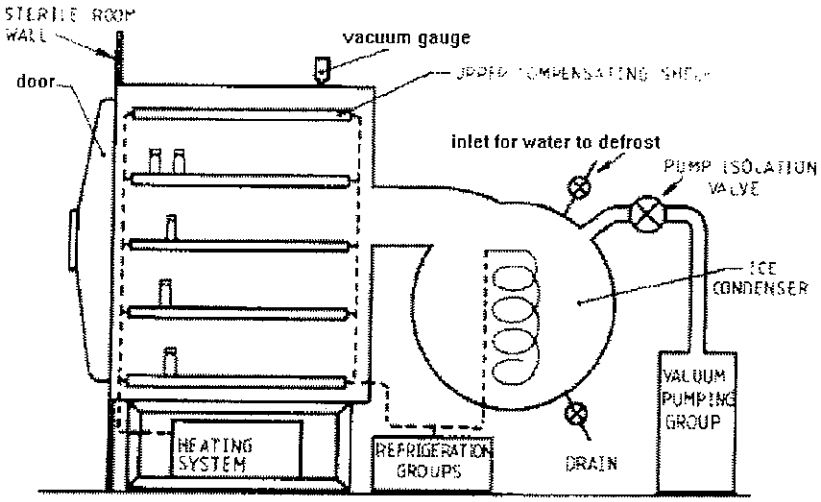
1. Mention the difference between adiabatic and non adiabatic dryers. (1 m)

2. Sketch the temperature patterns in batch and continuous counter current adiabatic dryer. (1 m)

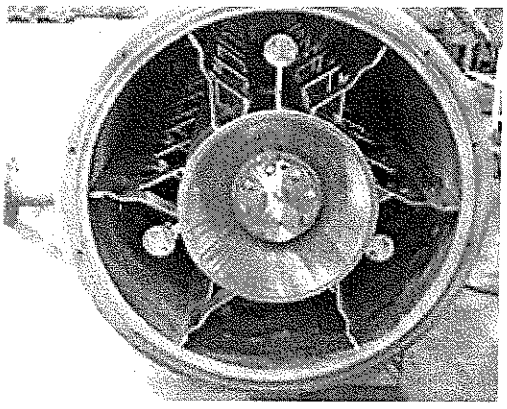
3. What is case hardening? (1 m)

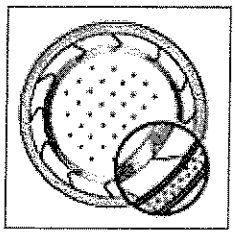
4. Mention the type of the dryer and explain its working principle. (3 m)

a)

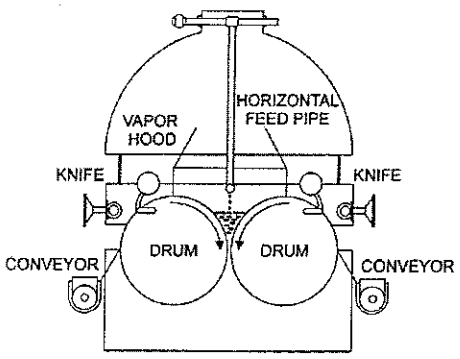


b)





5. Mention the major disadvantage for the following dryer. (1 m)



BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Quiz2** Date: 18.04.13

Course Title: Selected Chemical Engineering Operations Max Marks: 07

Duration: 20 minutes (Closed Book) Weightage: 07%

(Answering Scheme)

Name: . . . . . ID No: . . . . . Sec / Prog: . . . . . .

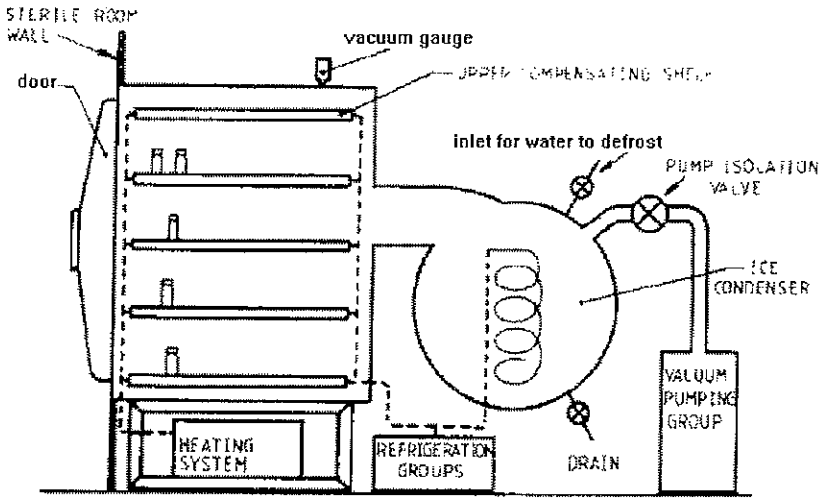
1. Mention the difference between adiabatic and non adiabatic dryers. (1 m)
Dryers that expose the solids to a hot gas are called adiabatic; those in which heat is transferred from an external medium are known as non adiabatic.

2. Sketch the temperature patterns in batch and continuous counter current adiabatic dryer. (1 m)
Refer class notes

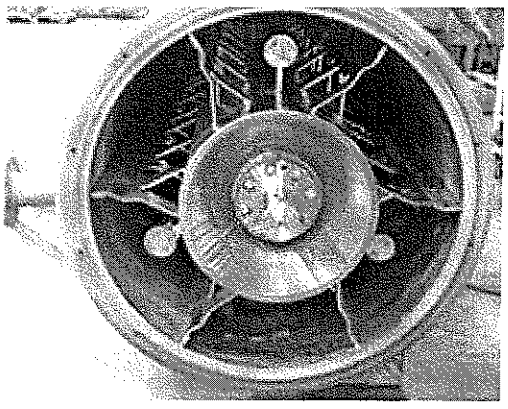
3. What is case hardening? (1 m)
Rapid drying may also make the surface shrunken material hard, enclosing the bulk of the solid so the interior moisture cannot be easily removed. This effect is called case hardening.

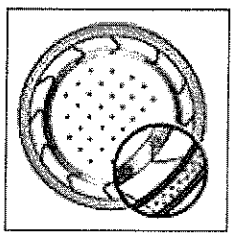
4. Mention the type of the dryer and explain its working principle. (3 m)

a)



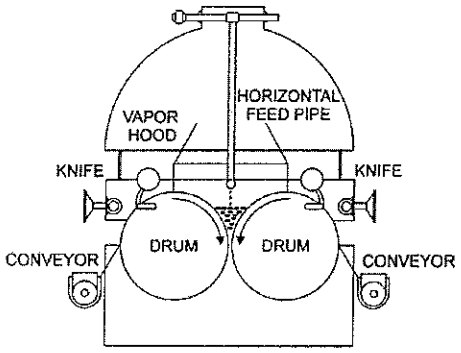
b)





a) Industrial lyophilizer; working principle refer class notes
b) Thin film dryer ; working principle refer class notes

5. Mention the major disadvantage for the following dryer. (1 m)



The major disadvantages of the drum dryer are
- That the process require large amount of energy at a relatively low thermal efficiency.
- The doctor knife requires frequent sharpening
- Uneven product thickness,
- Incomplete dryness, and inconvenient to make proper adjustment during operation.

BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Quiz1** Date: 28.02.13

Course Title: Selected Chemical Engineering Operations Max Marks: 08

Duration: 20 minutes (Closed Book) Weightage: 08%

Name: . . . . . ID No: . . . . . Sec / Prog: . . . . . .

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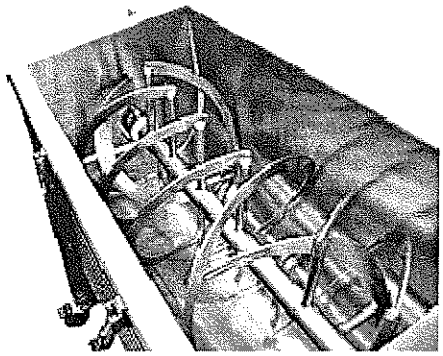
1. Mention any three crushers work by applying compressive force only. (1 m)

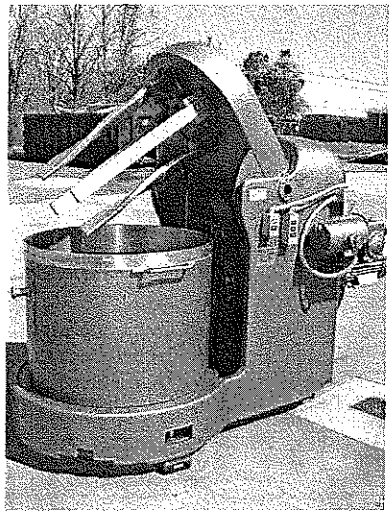
2. Depending on their flow properties, particulate soilds are divided into two classes _____ and _____ . Give examples (1 m)

3. Mention the name, type (category), working principle and application of the following equipments (1.5 × 4 = 6 m)

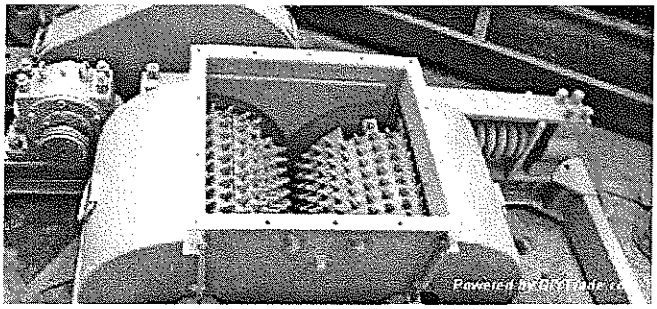
a)



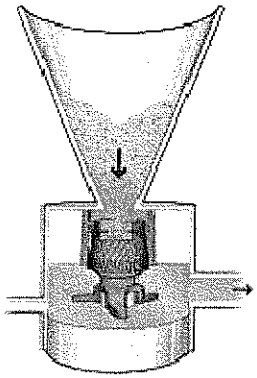
b)

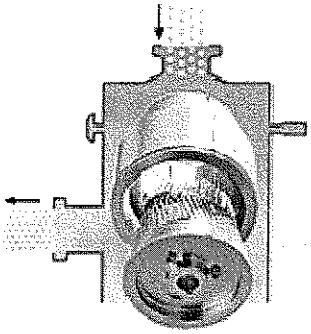


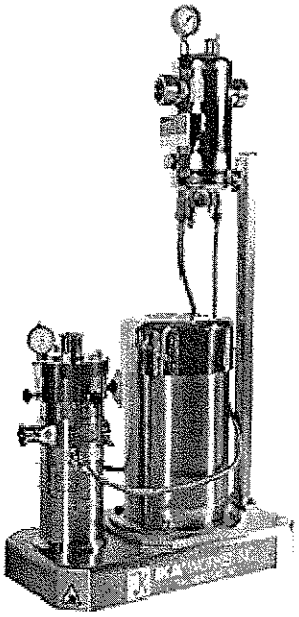
c)



d)







BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2012 – 2013

THIRD YEAR (Chemical)

Course Code: CHE C431 **Quiz1** Date: 28.02.13

Course Title: Selected Chemical Engineering Operations Max Marks: 08

Duration: 20 minutes (Closed Book) Weightage: 08%

(Answering Scheme)

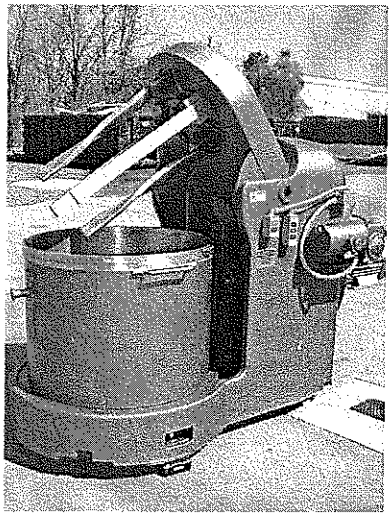
Name: . . . . . ID No: . . . . . Sec / Prog: . . . . . .

1. Mention any three crushers work by applying compressive force only. (1 m)
Jaw crusher, Gyratory crusher, roll crusher

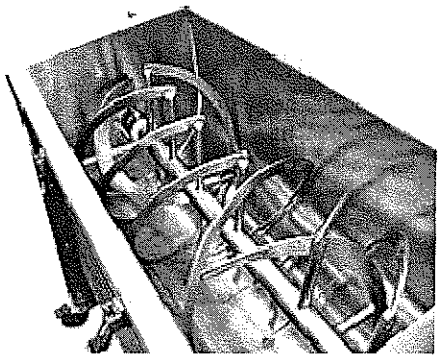
2. Depending on their flow properties, particulate soilds are divided into two classes _____ and _____. Give examples (1 m)
(cohesive and non- cohesive ex: cohesive- wet clay, non-cohesive – grain, dry sand, plastic chips)

3. Mention the name and type (category) of the following equipments with an example:
(1.5 × 4 = 6 m)

a)



b)



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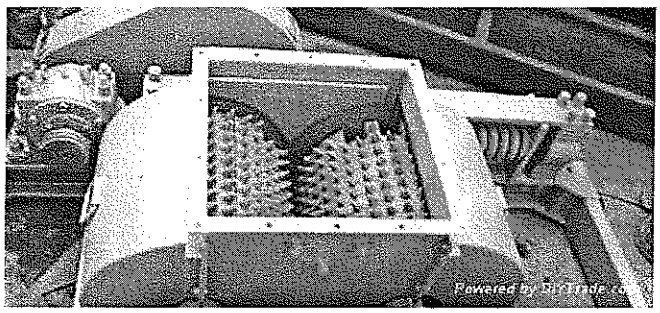
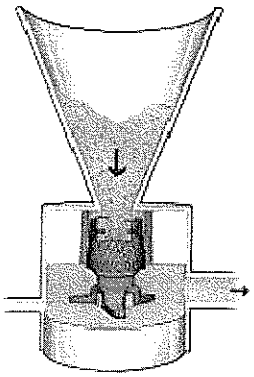
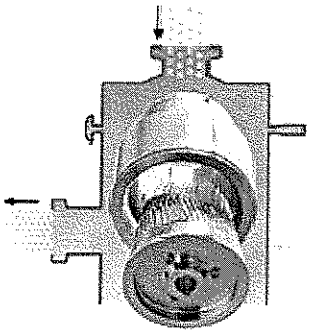
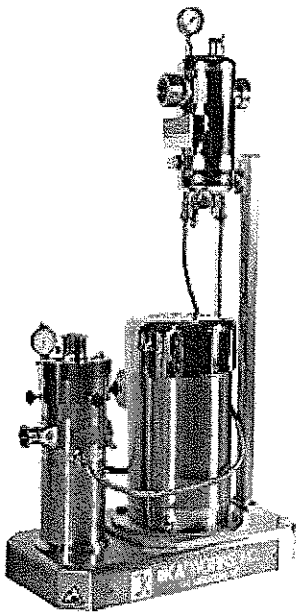


d)







a) Pony mixer – mixers for cohesive solids – blend viscous liquids or light paste – food processing, paint manufacture.

b) Ribbon mixer – two counter acting ribbons are mounted on the same shaft – mixers for non cohesive solids – food, pharmaceutical, chemicals, fertilizers, etc.

c) Toothed roll crusher – secondary crusher – equipment for size reduction – operated by compression and shear – softer materials such as coal, bone, soft shale

d) Toothed colloidal mill – ultra fine grinders - syrups, milk, ointments, paints, greases.