

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: 07.06.12

Course Title: Selected Chemical Engineering Operations

Max Marks: 70

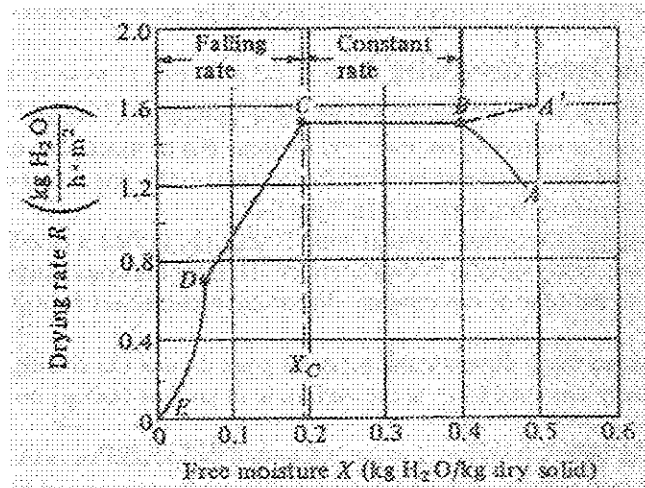
Duration: 3 hr

(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) Discuss in detail about the various size reduction mechanisms for any solid materials. (6 m)
- 1.(b) State Bonds Law. (2 m)
- 2.(a) Explain working principle of pebble mill with its significance. Explain how the critical speed can be found. (6 m)
- 2.(b) Give the applications of agitated mills. (2 m)
- 3.(a) Discuss in detail about the various mechanisms of filtration for any solid fluid materials. (6 m)
- 3.(b) Explain working principle of a precoat filters with its significance. (4 m)
- 4.(a) What is sorting Classifiers? Discuss its types in detail. (6 m)
- 4.(b) Discuss detail procedure to determine the area of thickener using batch sedimentation data. (4 m)
5. A batch of wet solids whose drying rate is represented by the below figure. It is to be dried from a free moisture content of $X_1 = 0.38$ kg H₂O/kg dry solid to $X_2 = 0.04$ kg H₂O/kg dry solid. The weight of dry solid is $L_s = 399$ kg dry solid and $A = 18.58$ m² of top drying surface. Calculate the time for drying. (8 m)



- 6.(a) Explain any two adsorption isotherms other than Freundlich and Langmuir. (4 m)
- 6.(b) Powdered activated carbon (PAC) is used to remove brown dye having initial concentration of 100 ppm from an aqueous waste. The above experiment is carried out in laboratory shaker with 50ml content for each batch at constant temperature of 30°C and the following data were obtained. Determine the maximum adsorption capacity and constants of Langmuir isotherm and mention its assumptions. (8 m)

Mass, mg	20	30	40	50	65	80
Equilibrium Conc, ppm	45	31	16.5	8	3	2

- 7.(a) Discuss the flow patterns in membrane separators. (4 m)
- 7.(b) Explain the following: (4 m)
- Pervaporation
 - Concentration Polarization
8. Discuss in detail about an industrial crystallizer with its working principle, advantages and its limitations. (6 m)

BITS, PILANI – DUBAI CAMPUS
SECOND SEMESTER 2011 – 2012
THIRD YEAR (Chemical)

Course Code: CHE C431

Course Title: Selected Chemical Engineering Operations

Duration: 50 minutes

TEST 2

(Open Book)

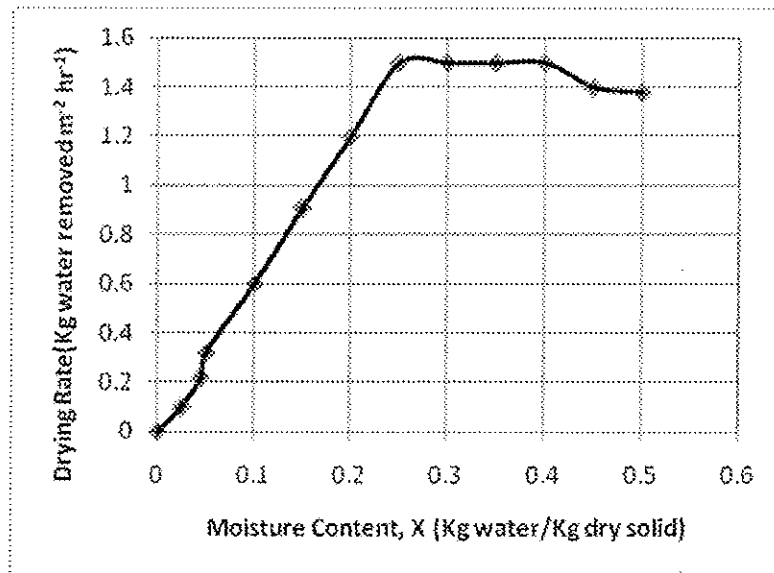
Date: 26.04.12

Max Marks: 15

Weightage: 15%

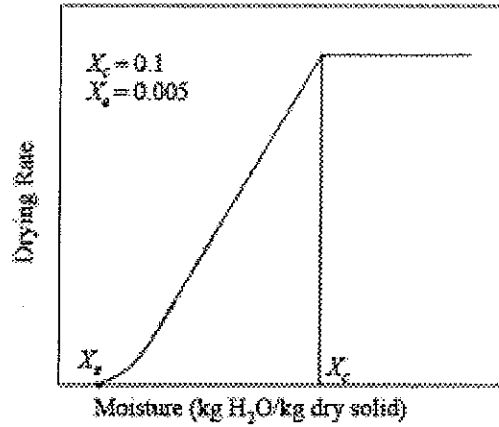
Note : only prescribed text book and own handwritten notes are allowed, physical and chemical property tables are allowed

1. A batch of 120 kg wet solids has initial moisture content of 0.2 kg water / kg dry solid. The exposed area of drying is $0.05 \text{ m}^2/\text{kg dry solid}$. Determine the time required (in hours) for drying this batch to a moisture content of 0.1 kg water/kg dry solid. The rate of drying follows the curve given below: (6 m)



2. Find the mass of moisture that would be removed when drying grain from 28% wet basis moisture content to 12% wet basis moisture content. The initial total mass of the grain is 800 Kg. What is the final total mass of the grain? (4.5 m)

3. Consider the drying operation shown in the figure below for a solid loading of 50 kg/m^2 with a constant drying rate of $5 \text{ kg/m}^2 \text{ h}$. the falling rate drying is linear with moisture content. Determine the drying time (in hrs) required to reduce an initial moisture content of 25% to a final moisture content of 2%. (All the data are given in dry basis). Derive the required equation. (2.5 + 2 = 4.5 m)



BITS, PILANI – DUBAI CAMPUS
SECOND SEMESTER 2011 – 2012
THIRD YEAR (Chemical)

Course Code: CHE C431

TEST 1

Course Title: Selected Chemical Engineering Operations

Duration: 50 minutes

(Closed Book)

Date: 11.03.12

Max Marks: 25

Weightage: 25%

-
1. Discuss in detail about the size measurement techniques for finer particles. (2 m)
 2. Laboratory studies of crushing have shown that less than 1 percent of the energy delivered to the solids is _____; rest is _____. (1 m)
(used to create new surface, dissipated as heat)
 3. Mention the crushing mechanism and significance of plows guide in a muller mixer. (1 + 1 m)
 4. How the degree of axial mixing is measured. (1.5 m)
 5. Mention the difference between disperser and intensive mixer. (1.5 m)
 6. The balls occupy about one _____ the volume of the mill. (1 m)
($\frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}$)
 7. What are bins and silos? (1 m)
 8. Discuss screen capacity Vs efficiency. (1 m)
 9. When a filtration operation is called jammed? (1 m)
 10. How the filters are divided? Discuss briefly (3 m)

BITS, PILANI – DUBAI CAMPUS
SECOND SEMESTER 2011 – 2012
THIRD YEAR (Chemical)

Course Code: CHE C431

Quiz2

Date: 22.05.12

Course Title: Selected Chemical Engineering Operations

Max Marks: 07

Duration: 20 minutes

(Closed Book)

Weightage: 07%

Name: ID No: Sec / Prog:

1. Match the units for various parameters (1 × 4 = 4 m)
- | | |
|---------------------|-------------------------|
| Knudsen Diffusion | kg cm ³ /sec |
| Polarization factor | kg ² /m sec |
| Mass flux | kg/m sec |
| J _w | none |
| | kg/m ² sec |
| | none |
| | cm ³ /sec |
| | kg/m sec atm |
| | none |
| | cm ² /sec |
| | none |
| | cm/sec |
2. What are the process alternatives for oxygen production from air separation? (1.5 m)
3. Mention the types of foulants. (1.5 m)

BITS, PILANI – DUBAI CAMPUS
SECOND SEMESTER 2011 – 2012
THIRD YEAR (Chemical)

Course Code: CHE C431

Course Title: Selected Chemical Engineering Operations

Duration: 20 minutes

Quiz1

(Closed Book)

Date: 03.04.12

Max Marks: 08

Weightage: 08%

Name: ID No: Sec / Prog:

1. Match the following (1 × 4 = 4 m)

- | | |
|--------------------------|---|
| a) Larox belt filter | rotary vacuum filter |
| b) Vacuum nutsche | discontinuous vacuum filter |
| | continuous pressure filter |
| | discontinuous pressure filter |
| | continuous vacuum filter |
| c) Shell and leaf filter | feed enters directly the side of the tank |
| d) Filter press | feed enters directly to the leaf |
| | feed enters directly to the plate |
| | feed enters directly to the frame |

2. Mention the pretreatment methods to increase the filtration rate. (1 m)

3. Give the examples for the following; (1 × 2 = 2 m)

- | | |
|--------------------------|-------------------------|
| a) filter aid | electroplating solution |
| b) clarifying filter pad | polypropylene |
| | perlite |
| | felt |
| | viscous oil |
| | lubricants |
| | aluminium trihydrate |

4. What is called direct sieving? (1 m)