GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Fifth Semester)

BCHPC 5020 – Mass Transfer II

(Chemical Engineering)

Time: 2 hrs   Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)   **(1 x 10 = 10 Marks)**

Q.1. Answer **ALL** questions

a. Rate of liquid-liquid extraction depends on

(i)	Diffusion	(ii)	Reactivity
(iii)	Temperature	(iv)	Pressure

b. In liquid-liquid extraction process the solvent should be

(i)	Chemically reactive	(ii)	Reactive and unstable
(iii)	Stable and inert	(iv)	All of these

c. The main theory of leaching neglects mechanisms

(i)	For holding the material as solid	(ii)	For losing the material as solid
(iii)	Both	(iv)	None of these

d. In leaching operation, for constant under flow $\frac{y}{x}$ is

(i)	1	(ii)	2
(iii)	3	(iv)	4

e. Adsorption of acetone vapour on activated can is

(i)	highly endothermic process	(ii)	an exothermic process
(iii)	a slightly endothermic process	(iv)	none of the above

f. Adsorption is often best choice for

(i)	Separation from a dilute solution	(ii)	Separation from a concentrated solution
(iii)	Both (i) and (ii)	(iv)	None of these

g. When hysteresis is observed, the adsorption equilibrium pressure

(i)	Is always equals to that obtained by adsorption	(ii)	Is always higher than that obtained by adsorption
(iii)	Is always lower than that obtained by adsorption	(iv)	May be equal to or higher than that obtained by adsorption

h. Mass of water held in a given volume of gas

(i)	Absolute humidity	(ii)	Relative humidity
(iii)	Both (i) and (ii)	(iv)	None of these

i. Basis for manufacturing instant coffee and laundry detergent involves

(i)	Batch drying	(ii)	Spray drying
(iii)	Both	(iv)	None of these

j. If radiation and conduction through solid are negligible, the rate of drying during the constant rate period

(i)	Increases with Increases in the mass velocity of gas	(ii)	Decreases with Increases in the mass velocity of gas
(iii)	Remains unaffected with change in the mass velocity of gas	(iv)	None of these

PART – B: (Short Answer Questions)   **(2 x 10=20 Marks)**

Q.2. Answer *ALL* questions

a. Define: plait point and Tie line.

b. What are the various factors which limits the rate of Solid-Liquid extraction?

c. What is heat of wetting? Give example.

d. Differentiate between physical adsorption and chemisorption.

e. Discuss the factors, which affect the rate of drying.

PART – C: (Long Answer Questions)   **(6 x 5 = 30 Marks)**

Answer *ANY FIVE* questions   Marks

3. It is desired to reduce the concentration of pyridine in 500 kg of aqueous solution   (6)
from 20 weight percent to 5 wt percent in a single batch extraction using
chlorobenzene as solvent. Equilibrium compositions (end points of the tie line) in
terms of weight percent of pyridine-water-chlorobenzene are (5, 95, 0) and
(11, 0, 89). Then calculate the amount of pure solvent required in kg for the
operation.

4. Explain how you will find out the final composition of the solute in the raffinate   (6)
for immiscible solvent and diluents in single and multistage cross current
extraction.

5. What is the principle of leaching? Describe the Bollman extractor used in leaching   (6)
operation.

6. 500kg/hr. of mustard cake is to be extracted in a counter current cascade with ether   (6)
to recover oil. The ether which has been partially purified contains 5% oil. The
fresh cake contains 15% oil and is to be extracted to a composition of 2% oil
(on solvent free basis). If 200kg of solvent is to be used, What percentage of oil
entering with the cake is recovered in the extract?

7. Sketch and explain the shape of different equilibrium adsorption isotherms using an   (6)
appropriate plot.

8. Carbon disulphide is to be absorbed from a dilute gas mixture **CS_2-N_2** into pure   (6)
non-volatile oil at atmospheric pressure in a counter current absorber. The mole
fraction of **CS_2** inlet gas stream is 0.05 and the flow rate of gas stream, **G** is
1500koml/hr. The equilibrium relation is given by; **$Y = 0.5 X$**

Where, **X** is the mole fraction of CS_2 in liquid stream. It is desired to reduce the
mole fraction of CS2 in the gas stream is 0.005.

   (i)   Calculate the minimum value of **L/G**, where L is the liquid flow rate in
       kmol/hr.

   (ii)   Derive the equation for the operating line if **L/G** is equal to 1.5 times
       the minimum values.

9. It is desired to dry a certain type of fiber board in sheets 13.1centimeter by   (6)
16.2 centimeter by 7.1 centimeter from 58% to 5% moisture (wet basis) content.
Initially from laboratory test data with this fiber board, the rate of drying at
constant rate period was found to be 8.9 kg/m^2 hr. The critical moisture content
was 24.9% and the equilibrium moisture content was 1%. The fiber board is to be
dried from one side only and has a bone-dry density of 210 kg/m^3. Determine the
time required for drying. The falling rate may be assumed liner.

10. Explain the principle and applications of rotary drier with neat diagram.   (6)

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