Ref. No. : Ex/PHARM/T/424/2018

Name of the Examinations: B. PHARMACY FOURTHYEAR SECOND SEMESTER - 2018

Subject
PHARMACEUTICALENGINEERING -II **Time :** 3 hr **Full Marks :** 100

(Answer any five questions taking at least two questions from each group.)

GROUP A

Q1.A feed mixture (25000 kg/hr) of 50 mole percent benzene (MW 78, latent heat of vaporization,λ, 7360 cal/gm mole) and toluene (MW 92, latent heat of vaporization,λ, 7960 cal/gm mole) is to be separated by a continuous fractionating column at atmospheric pressure, into 95 mole percent benzene as overhead product and 93 mole percent toluene as bottom product using a reflux ratio of 2.5 times the minimum value of R_{Dm} .The column contains 15 stages including reboiler. Cold feed is used at 25°C (specific heat 0.44 cal/gm/C).Relative volatility of benzene is 2.45.

(i) Calculate overhead and bottom products in kg/hr and N_{min}.
(ii) How many theoretical stages are required, and what is the % of efficiency?
(iii) Report number of total stages including reboiler, number of stages in rectifying section, number of stages in stripping section and position of feed plate in the column.
(iv) If steam at 20 psi(latent heat of vaporization , 522 cal/gm) is used for heating , how much steam is required in kg/hr?
(v) If cooling water enters the condenser at 25°C and leaves at 45°C , how much cooling water is required in cubic meter /hr? (density of water is 996 kg/m^3)
(vi) Write the equations of Ist, 2nd operating lines and feed line using calculated data and graphical data.

Equlibrium data of benzene –toluene system

x	1	0.78	0.58	0.41	0.26	0.13	0
y	1	0.9	0.78	0.63	0.45	0.26	0

Marks 20

Q2.(i)Discuss the factors which control rate of extraction in leaching operation.

(ii) Write on principle, construction, operation, advantages of Rotocel extractor.

(iii) A feed of 100 kg/min of 1.2 % mixture of acetic (AA) in water is to be extracted with 1-butanol at 1 atmosphere and 26.7°C. The desired outlet concentration in the exiting stream is 0.1 wt% of acetic acid. Determine the composition of the exiting 1-butanol phase (extract phase) . Determine the number of equilibrium contacts (stages) needed. The equilibrium equation for acetic in 1-butanol-water is y=1.613 x.

Draw flow sheet diagram of this countercurrent extraction problem with required labels and data.

Y= Mass of AA/mass of (AA + 1-butanol), x= Mass of AA/mass of (AA + water)

Marks 5+5+10

Q3. Write short notes on any five of the following:

(i)Characteristics of ideal solvents in extraction.

(ii)Derivation of operating line for countercurrent extraction by mass balance.

(iii)Flash distillation alongwith derivation of equation.

(iv) Batch distillation alongwith derivation of equation.

(v)Multi stages Mixer settler assembly for liquid- liquid extraction with neat diagram.

(vi)Types of downcomers in fractionating column.

(vii)Brief description of bubble cap column with neat diagram.

Marks 5x4

B. PHARMACY FOURTH YEAR SECOND SEMESTER - 2018

PHARM. ENGINEERING -II TIME: 3 h FULL MARKS: 100

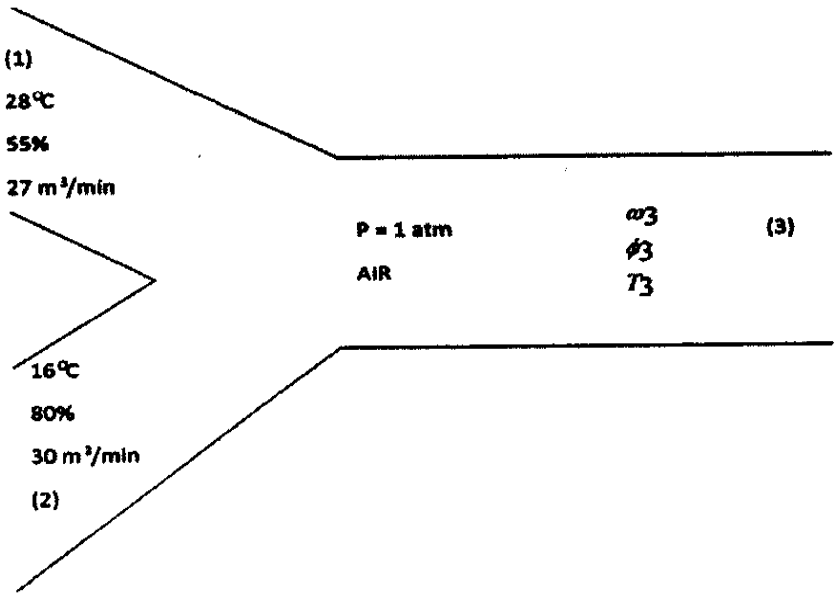
ANSWER ANY FIVE QUESTIONS TAKING ATLEAST TWO FROM EACH GROUP

GROUP-B

(Use graph paper and psychometric chart as required)

1.

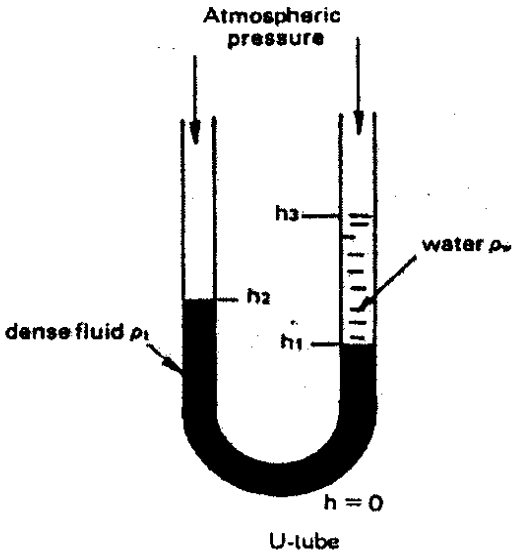
a. Two airstreams are mixed steadily. The specific humidity, the relative humidity, the dry-bulb temperature, and the volume flow rate of the mixture are to be determined.



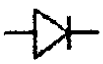
b. Solute A is to be absorbed from a binary mixture containing 8 % of A with solvent B in a packed tower. Based on flooding calculation, a tower diameter of 2 m is selected. Total gas flow rate is 70 kmol/h. The exit gas must not contain 0.4% of solute A. Solute free liquid B enters from the top of the tower at 30 kmol/h. The gas phase and liquid phase mass transfer coefficients based on mole ratio unit are: k_X =2.15 kmol/m^{2}h (ΔX) and k_Y =2 kmol/m^{2}h (ΔY). The equilibrium line Equation is Y=0.8X. Specific interfacial area of gas-liquid contact ($\bar{a}$) is 74 m^2/m^3. (i) Calculate packing height required for the desired separation. (ii) For 98.5% solute A removal, what % increase in packed height is needed? (iii) Determine slopes of operating line in each case. [10+10=20 marks]

2.

a. It is desired to absorb 90% of acetone by water from a mixture of acetone and nitrogen containing 2% of the component in a counter current tray tower. Total gas input is 35 kmol/hr and water enters the tower at a rate of 80 kmol/hr. The tower operates at 30°C and 1 atm. The equilibrium relation is Y=2* X. Determine the number of ideal stages necessary for the separation using (a) graphical method as well as (b) Kremser analysis method.



b. Derive a schematic diagram of classification of materials for plant construction.
c. Write the advantages and disadvantages and uses of various composition of S.S. alloys.
d. Write short note on Glassed steel.
e. Write brief separation of Drug-plastic consideration.
f. Match the following:

a.		i. Strainer
b.		ii. Centrifugal compressor
c.		iii. pulverizer
d.		iv. Check or non-return valve
e.		v. Batch reactor (with jacket as well coil)

g. A wet solid of 30% moisture is to be dried to 0.6% moisture in a tray drier. A laboratory test shows that it requires 10 h to reduce the moisture content of the same solid to 4%. The critical moisture content is 8% and the equilibrium moisture is 0.09%. The falling

rate of drying is linear in the free moisture content. Calculate the drying
if the drying conditions similar to those in the laboratory tests are
moistures are expressed as per cent of "bone dry" mass of the solid.

[3+1+2+2+2-

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