Q. Code: 131353

Reg. No. | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Sixth Semester

CH16604 – MASS TRANSFER-II

(Chemical Engineering)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

(*Heat and mass transfer data book/ psychrometric chart can be allowed*)

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	State the effect of temperature and pressure on absorption.	3	R
2.	What is the slope of the operating line of an absorption column and how it is related to absorption factor?	1	U
3.	Which method is more accurate in finding ideal number of stages: Ponchon-Savarit method or McCabe Thiele method? Justify your answer.	1	E
4.	State the significance of Fenske's equation.	1	U
5.	Metal separation such as Uranium – Vanadium, Tungsten – molybdenum and the fission products of atomic energy process are more economically removed by which specific process.	3	U
6.	What is distribution coefficient and explain how it influences the choice of solvent used for extraction?	3	U
7.	Distinguish percolation method and dispersed solids leaching.	2	AN
8.	State the differences between half miscella and full miscella.	3	AN
9.	What is the effect of pH on adsorption of organic material?	3	U
10.	Mention some of separation processes which works based upon size property alone.	4	R

PART B - (5 X16 = 80 Marks)

11.	(a)	A packed tower is designed to recover **98%** CO_2 from a mixture containing **5%** CO_2 and **95%** air using water. A relation **Y=14X** can be used for equilibrium conditions where Y is kg CO_2/kg dry air and X is kg CO_2/kg water. The water to gas rate is kept **50%** more than the minimum requirement. Calculate the height of the tower if HTU_{OG} is **1.5** meter.	**(16)**	1	AP

(OR)

(b) An Air – CO_2 mixture containing **10 mole %** of CO_2 is being treated with Monoethanolamine (MEA) in a packed tower to recover **95%** of CO_2, using **2.0** times the minimum MEA flow rate. If the temperature is **35 deg C**, total pressure (PT) is **1atm** and vapor pressure of CO_2 at column conditions is **576 mm of Hg**. Determine the theoretical number of stages required for incoming gas rate of **1000 Kg/(hr m^2)**. **(16)** **1** **AP**

12. (a) An equimolar feed of **A & B** is to be fractionated to get a top and a bottom product of **95%** and **6%** of **A** respectively. The feed is a saturated liquid at its boiling point and is fed at the rate of **5000 Kg/hr**. Total condenser is used and reflux returned to the top plate as a saturated liquid. The equilibrium data at **1 atm** pressure is given as : **(16)** **1** **AP**

x	**0**	**0.06**	**0.11**	**0.26**	**0.39**	**0.53**	**0.66**	**0.76**	**0.86**	**1.0**
y	**0**	**0.16**	**0.27**	**0.50**	**0.63**	**0.75**	**0.83**	**0.88**	**0.93**	**1.0**

Where, **X, Y** are mole fractions of **A** in liquid and vapor phase respectively.

(i) Determine the product rate in kg per hour.

(ii) What is the minimum reflux ratio (**R_{min}**)?

(iii) Determine the theoretical number of plates required and the feed plate location if the tower is operated at **2.0** times **R_{min}**.

(OR)

(b) It is decided to separate a equimolar mixture of vapour and saturated liquid in a plate type distillation column, the feed contains **40 mole %** of **A** and top product is to contain **95 mole %** of **A** and bottom product to contain **5 mole %** of **A**. Determine the number of theoretical plates needed if the reflux ratio is **2.5** times the minimum is used. Given the equilibrium data in mole fraction is as follows: **(16)** **1** **AP**

x	**0**	**0.16**	**0.40**	**0.60**	**0.80**	**1.0**
y	**0**	**0.30**	**0.63**	**0.78**	**0.89**	**1.0**

13. (a) With a neat sketch explain the operation of (i) Rotating Disc Contactor and (ii) Pulsed column extractor. **(16)** **2** **U**

(OR)

(b) If 1000 kg/hr of Nicotine in water solution containing 1% nicotine content is to be counter currently extracted with kerosene to reduce the nicotine content to 0.1%. Determine number of theoretical stages required if 1150 kg of kerosene is used per hour. **(16)** **2** **U**

x = kg nicotine/kg H_2O	0.002	0.004	0.006	0.008	0.01
y = kg nicotine/kg kerosene	0.0017	0.003	0.005	0.007	0.009

14. (a) Vegetable oil seeds containing 100 g of insoluble solids and 10 g of oil are contacted with 200 g of organic solvent in a single stage leaching operation. The solvent used is fresh. Determine the amount of oil left in the oil seeds after leaching. The equilibrium can be expressed as N(g insoluble)(g solvent + g oil) = -4y + 8, where **(16)** **3** **U**

y = g oil / (g solvent + g oil) in seed (under flow)

x = g oil / (g solvent + g oil) in solvent phase (over flow)

Eg. data

x :	0.26	0.28	0.31	0.34
y:	0.02	0.04	0.06	0.08

(OR)

(b) With a neat sketch explain the operation of Bollman and Rotocel extractor. **(16)** **3** **U**

15. (a) Explain about adsorption equilibrium and various adsorption isotherm models. **(16)** **4** **U**

(OR)

(b) Explain the principle and operation of Ion exchange, Reverse Osmosis and Electro Dialysis with respect to treatment of water. **(16)** **4** **U**