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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH5DCMT2 **Max Marks: 100**
Course: Mass Transfer-II **Date: 12.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1. a) Define and discuss the following **06**
   i. Point efficiency
   ii. Murphree efficiency
   iii. Minimum liquid –gas rate ratio for absorber

   b) What is the meaning of HETP? How one can estimate its value? Give its application. **04**

   c) Ammonia is to be removed from a mixture of 20% ammonia and 80% air by counter –current scrubbing with water at 1 atm and 20 ℃ . Evaluate the minimum solvent rate if 99% of ammonia is to be removed and also the theoretical stages for actual absorption with 1.2 times the minimum solvent rate. The rate of flow of the mixture is 3500 kg/h. **10**

Data:

Partial pressure of ammonia, mm Hg	12	18	32	50	70	166
g of ammonia/10 g of water	0.2	0.3	0.5	0.75	1	2

OR

2. a) Discuss the factors to be considered while choosing between tray towers and packed towers. **06**

   b) What are the methods of evaluating the height of packed tower using HTU and NTU values? Explain. **06**

   c) Explain the construction of tray tower with the help of a neat sketch. **08**

UNIT - II

3 a) Steam is supplied into a still containing nitrobenzene with minute water soluble impurities at the total pressure is 130 mm Hg. Vapors leaving the still are condensed and separated in a separating funnel. Estimate the temperature of boiling and the composition of the distillate. Find the economy of steam. Saturation pressure data of major components is given below. **10**

Saturation pressure, mm Hg		100	50	30	26
Temperature, ℃	Chlorobenzene	70.4	53.7	42.7	34.5
	Water	51.7	38.5	29.9	22.5

b) Explain the equilibrium flash vaporization and differential distillation techniques of separation of components from a solution. **10**

OR

4. a) Discuss the location of q-line for various feed conditions. Derive the feed line equation. **10**

b) A solution of 60% benzene and rest toluene at saturated liquid state is to be continuously distilled to produce a distillate with 90% benzene and residue with 5% benzene. The column operates at a pressure of 1 atm. A reflux ratio of 2.1 is to be maintained. How many theoretical plates must the column have? All the percentages are on mole basis. **10**

VLE data:

x	0	0.10	0.20	0.30	0.50	0.60	0.70	0.80	0.90	1
y	0	0.20	0.38	0.51	0.71	0.78	0.85	0.91	0.96	1

UNIT - III

5. a) Explain the stepwise procedure for calculating number of theoretical trays required for separation of components from an ideal binary system using Panchon-Savarit method. **10**

b) What is the principle governing the molecular distillation? Explain the process with applications. **05**

c) Differentiate between the extractive distillation and azeotropic distillation. **05**

UNIT - IV

6. a) Specify the factors governing the selection of solvent for extraction operation. **04**

b) With a neat diagram, explain the working and construction of rotating disc contactor used in industries. **06**

c) A multistage cross current extraction system is used to extract dioxane from a binary mixture of dioxane and water using benzene as a solvent. The aqueous feed is available at 150 kg/h containing 20 % by weight of dioxane. The system has 3 stages and 120 kg/h of fresh solvent is to be used in each stage. The solvent feed contains 2 % dioxane. Assuming that each stage is an ideal one, estimate the final dioxane content in water. The miscibility of benzene in water may be neglected. **10**

The solubility of dioxane in water and benzene at equilibrium is given below.

Weight % of dioxane in water	2.8	5.1	18.9	25.2	33.06
Weight % of dioxane in benzene	3.1	5.23	22.49	32.03	46.35

UNIT - V

7. a) Explain the typical equilibrium diagrams for leaching with the help of neat diagrams. **06**

b) With a neat line diagram, explain the working of any one of the leaching equipment employed for separation used in industries. **08**

c) Explain the single stage leaching operation. How do you estimate the quantity of the leaching solvent required using the equilibrium data? **06**

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