

Subject: Mass Transfer -1

Subject code: 18CH52

Total marks: 100

Note :

- 1. Answer any five full questions, choosing one full question from each module.
Use of humidity chart permitted.**

Module 1		
1 a	Water level in a 1m diameter well in a desert is 12m deep from surface .The stagnant air and water in well are at a pressure of 750 mmHg and 30· C.A gentle breeze of air is blowing across top of well. Calculate loss of water in kg/hr due to steady state diffusion from surface of water. $D_{AB}= 2.6 \cdot 10^{-5} \text{ m}^2/\text{s}$ and Vapor pr= 0.045 atm	10
b	Applying basic flux equation, derive an expression for steady state counter current diffusion of a gaseous component. State the assumptions.	10
OR		
2	Define stage and cascades. Develop material balance equation for steady state counter current cascades. Explain the graphical procedure for determining number of stages required for counter current cascades.	20
Module 2		
3 a	Define the following : i) Constant rate (ii) Falling rate period (iii) Free moisture content (iv) Absolute humidity (v) % Humidity	10
b	A mixture of acetone vapor and nitrogen gas at 101.3 kpa and 310 K contains acetone vapor to the extent that it exerts a partial pressure of 15kpa. The vapour pressure of acetone is 26.36 kpa. Determine the following. (i) Mole fr (ii) Wt.fraction (iii) molal humidity (iv) saturation humidity	10
OR		
4	With a neat sketch explain different types of cooling tower.	20
5 a	A 100kg of solids containing 30% moisture is to be dried in a tray dryer to 16% moisture by passing a current of air at 350 K across its surface at a velocity of 1.8 m/s. If the constant rate of drying under these conditions is $0.7 \times 10^{-3} \text{ kg}/(\text{m}^2\text{s})$ and the critical moisture content is 15% , calculate the drying time. Drying surface = $0.03 \text{ m}^2/\text{kg}$ dry wt.	12
b	Derive the equation to determine total time required for drying.	08
Module 3		
6	With a neat sketch explain any two type of drying equipment	20
OR		
7 a	Compare physical and chemical adsorption.	08
b	With a neat sketch explain fixed bed adsorber.	12
Module 4		
8	An aqueous solution containing valuable solute is colored by small amounts of an impurity. It is to be decolorized by adsorption of an impurity on adsorptive carbon. The equilibrium data obtained by stirring various amounts of adsorbents with original solution at constant temperature are as follows.	20

	<p>Kg carbon 0 0.001 0.004 0.008 0.02 0.04</p> <p>/Kg solution</p> <p>Eq.Color 9.6 8.6 6.3 4.3 1.7 0.7</p> <p>The original solution has a color concentration of 9.6 measured on an arbitrary scale and it is desired to reduce the color concentration to 10 % of its original value. Calculate the quantity of fresh carbon required if 1000kg of solution is used for single stage operation.</p>	
	Module 5	
9	With a neat sketch explain any two types of crystallizer.	20
	OR	
10	<p>Write short notes on the following</p> <p>i) Reverse osmosis</p> <p>ii) Ultra filtration</p> <p>iii) Ion Exchange</p> <p>iv) Dialysis</p>	20