Paper code: CH-501	Roll No.											

B.TECH
(SEM V) ODD SEMESTER EXAMINATION, 2015-16
MASS TRANSFER OPERATIONS-I

Time: 3 Hours   Max. Marks:100

Note: Attempt all questions. All questions carry equal marks. Assume suitable data if missing.

1.   Attempt any four parts of the followings: (5x4=20)

   (a) What is Fick's law of diffusion? Explain their significance with respect to stationary co-ordinates.
   (b) Explain molecular diffusion in fluids with suitable examples.
   (c) What are different kinds of mass transfer coefficients?Discuss their significance also.
   (d) Write the names of different film theories? Explain any one of them in brief.
   (e) Explain the Knudsen and surface diffusion in solids.
   (f) On what factors does the mass transfer rate between two fluid phases depend? Explain in brief.

2. Attempt any two parts of the followings: (10x2=20)

   (a) 5000 kg/hr of SO_2-air mixture containing 5% by volume SO_2 is to be scrubbed with 200,000 kg/hr of water in a packed tower. The exit concentration of SO_2 is reduced to be 0.15%. The tower operates at 1 atmosphere. The equilibrium relationship is given by

$$Y = 30X$$

   Where, Y = Mole SO_2/ Mole air and X = Mole SO_2/ Mole water

   If the packed height of the tower is 420 cm, estimate the height of transfer unit (H.T.U).

   (b) Explain the significance of following in the design of absorption column:

   (i)   Flooding velocity
   (ii)   Theoretical stage
   (iii)   Absorption factor

   (c) Describe HTU, NTU and HETP concepts. Write all the necessary requirements of a suitable solvent.

3. Attempt any two parts of the followings: (10x2=20)

(a) Draw diagram and explain working of forced draft and induced draft cooling towers.

(b) Define and give the significance of relative saturation and percent saturation. Establish the relation between these saturations for an unsaturated air water vapor mixture.

(c) Define and give the significance of wet bulb temperature. Also derive the following equations for the wet bulb temperature:

$$t_G - t_W = \frac{\lambda_w}{h_G / k_y}(Y_W^{'} - Y^{'})$$

4. Attempt any two parts of the followings: (10x2=20)

(a) A certain material is dried under constant drying conditions and it was found that 2 hours ae required to reduce the free moisture concentration from 20% to 10 %. How much longer would be required to reduce the free moisture to 4%? Assume that no constant rate period is encountered.

(b) What is drying? Explain the various types of dyers used in chemical industries.

(c) Draw and discuss the variation of the rate of drying with moisture content on dry basis. Give the graphical presentation of rate of drying.

5. Write any four of the followings: (5 x 4 = 20)

(a) What is crystallization? Give examples of batch crystallizers and continuous crystallizers.
(b) Differentiate between homogeneous and heterogeneous nucleations.
(c) Explain the working of agitated batch crystallizer with a neat diagram.
(d) Define super saturation. Also discuss the variation of solubility of solid solute in liquid solvent with temperature.
(e) Explain the parameters controlling the crystal size distribution in a crystallizer.
(f) Write material and energy balance for crystallization.