

**B.TECH. SEM -V (CHEMICAL 2014 COURSE (CBCS) : WINTER -  
2017**

**SUBJECT : MASS TRANSFER OPERATION**

Day : **Thursday**  
Date : **11/01/2018**

**W-2017-2111**

Time : **02.30 PM TO 05.30 PM**  
Max. Marks : **60**

**N.B.**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Steam tables are **ALLOWED**.

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- Q.1** a) Derive the equation for steady state diffusion of A through non diffusing B. **(06)**  
b) Write a short note on diffusivity of gases. **(04)**

**OR**

- Q.1** a) Derive the equation for steady state equimolar counter diffusion. **(06)**  
b) Write a short note on diffusivity of liquids. **(04)**

- Q.2** Derive the equation for mass transfer coefficient in laminar flow, if mass transfer takes place from a gas into a falling liquid film. **(10)**

**OR**

- Q.2** Write a short note on: **(10)**  
a) Film theory  
b) Penetration theory  
c) Surface renewal theory

- Q.3** a) Write a short note on "choice of solvent for absorption". **(05)**  
b) Explain in detail one component transferred; material balances for counter current flow. **(05)**

**OR**

- Q.3** Write a short note on: **(10)**  
a) Tray efficiencies  
b) Minimum liquid-gas ratio for absorbers  
c) Types of tower packing's

- Q.4** Define and explain following terms: **(10)**  
a) Adiabatic saturation temperature  
b) Wet bulb temperature  
c) Dry bulb temperature  
d) Lewis relation  
e) Humid Heat

**OR**

- Q.4** a) Explain in detail vapour liquid equilibrium for a pure substance. **(05)**  
b) Explain in detail enthalpy temperature diagram for a pure substance. **(05)**

P.T.O.

- Q.5** 1000 kg (dry mass) of non-porous solid is dried under constant drying conditions with an air velocity of 0.75 m/s. The area of drying surface is 55 m<sup>2</sup>. If the initial rate of drying is 0.3 g/m<sup>2</sup>s, how long it will take to dry a material from 0.15 to 0.025 kg water/kg dry solid? The critical moisture content is 0.125 kg water/kg dry solid. Assume that the falling rate is linear. The equilibrium moisture content may be assumed to be zero. If the air velocity is increased to 4 m/s, what will be anticipated saving in drying time? Assume that the rate of evaporation in constant rate period is proportional to the air velocity raised to the power of 0.80. **(10)**

**OR**

- Q.5** It is desired to dry sheet material from 55% to 4% moisture content. The sheets are 125 cm by 140 cm by 5 cm. The drying rate during constant rate period is 1.5 g/cm<sup>2</sup>.hr. The critical moisture content is 26% and the equilibrium moisture content is negligible. If the material is dried from both sides and has a bone dry density of 4000 kg/m<sup>3</sup>, estimate the time required for drying, assuming the falling rate to be linear. **(10)**

- Q.6** Calculate the yield of Mg SO<sub>4</sub>.7H<sub>2</sub>O crystals when 1000 kg saturated solution of MgSO<sub>4</sub> at 353 K is cooled to 303 k assuming 10% of the water is lost by evaporation during cooling. Solubility of MgSO<sub>4</sub> at 353 k = 64.2/100 kg of water. Solubility of MgSO<sub>4</sub> at 303 k = 40.8/100 kg water . At Wt. Mg = 24, S = 32, H = 1 and O = 16. **(10)**

**OR**

- Q.6** a) Explain in detail Meir's super saturation theory. **(05)**  
b) Derive the equation for calculating yield of the crystallization operation in crystallizer. **(05)**

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