

**Time – 3 hrs****Marks -80**

**N.B – Question no 1 is compulsory.  
Solve any three questions from remaining five questions.  
Assume suitable data if necessary.**

- Q.1 a) Write and explain Fick's law of diffusion 3
- b) Explain Absorption factor and Stripping factor 5
- c) Explain Knudsen Diffusion with its equation 4
- d) Define Cascade, Equilibrium Moisture content, Humid heat, Unbound moisture. 8
- Q.2 a) The diffusivity of gas pair  $O_2$ - $CCl_4$  is determined by observing the steady state evaporation of  $CCl_4$  (liquid) into a tube containing  $O_2$ . The entire system is held at constant temperature and pressure. Both the gases are assumed to be ideal and  $O_2$  is stationary. The distance between the  $CCl_4$  (liquid) level and top of the tube is 0.171 m. The total pressure on the system is  $100.658 \times 10^3 \text{ N/m}^2$  and temperature is  $273^\circ\text{K}$ . The vapor pressure of  $CCl_4$  is  $4.399 \times 10^3 \text{ N/m}^2$  at that temperature. The cross-sectional area of the tube is  $0.082 \times 10^{-3} \text{ m}^2$ . After steady state is attained,  $0.0208 \times 10^{-6} \text{ m}^3$  of  $CCl_4$  (liquid) evaporated in a  $36 \times 10^3$  seconds period. What is the diffusivity of gas pair  $O_2$ - $CCl_4$ ? Assume specific gravity of liquid  $CCl_4$  as 1.59. 10
- b) Explain difficulties of Packed tower like Flooding, Priming, Coning, Weeping, and Entrainment of liquid droplets are to be handle in detail. 10
- Q.3 a) Derive the relation between overall Mass Transfer Coefficient and Individual Mass Transfer Coefficient in both gas phase and liquid phase controlled 10

- b) Write Short note on 10
- i. Sparged Vessel
  - ii. Venturi scrubber
- Q.4 a) Compare Packed tower and Tray tower 8
- b) An air-ammonia mixture containing 5% ammonia by volume 12  
 is absorbed in water at 20°C in a tower packed with 1.27cm raschig rings. The water and the gas rates are 1170 Kg/hr m<sup>2</sup> each based on an empty tower cross section. Estimate the height of tower required if 98% the ammonia in the entering gas is to be absorbed. The tower operates at 1 atm pressure. The equilibrium relation is given as  $y = 0.746x$ .  
 where,  $y$  = mole fraction of ammonia in air, and  
 $x$  = mole fraction of ammonia in water.  
 Overall height of the transfer unit can be taken as 2 meter.
- Q.5 a) Give classification of cooling tower. Explain mechanical draft 8  
 cooling tower in detail
- b) 1) Explain in detail Typical rate of Drying Curve with neat 6  
 diagram.
- 2) Explain mechanism of drying. 6
- Q.6 Write short note on any four 20
- a) Wetted wall column
  - b) Diffusion through polymers
  - c) Rotary drum dryer
  - d) Tray Efficiency
  - e) Packing used in absorption column