(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 154603 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VI) THEORY EXAMINATION 2013-14

HEAT & MASS TRANSFER

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions. Assume suitable data, if required. All questions carry equal marks.

1. Attempt any **four** parts of the following : **(5×4=20)**

   (a) Define thermal conductivity of a material with suitable examples.

   (b) Explain critical thickness of insulation. Explain with suitable example.

   (c) Derive the expression for heat-transfer rate for steady state conduction through a spherical wall.

   (d) Define 'Free convection' and differentiate it with, Forced convection with suitable example.

   (e) Differentiate between Film wise and Drop wise condensation with suitable example.

   (f) Discuss *Black body & Gray body* with suitable examples.

2. Attempt any **two** parts of the following : **(10×2=20)**

(a) Define Kirchhoff's law. Derive the expression for view factor calculation with suitable examples.

(b) Discuss the working principle of a 1-2 Shell & Tube Heat Exchanger with neat diagram and complete calculation procedure.

(c) Explain the steam economy of an evaporator. Show various methods of feed in a Triple effect evaporator with suitable diagram.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Discuss the Fick's law of diffusion with suitable example. Also explain the dependency of diffusion coefficient on temperature.

(b) Discuss the 'Penetration theory' of mass transfer at fluid surfaces. Give the complete procedure for the determination of mass transfer coefficients with suitable example.

(c) Show that the diffusion coefficients D_{AB} and D_{BA} are equal for a binary mixture (A-B) with constant molar density.

In an O_2-N_2 gas mixture, the concentrations of oxygen at two planes 2 mm apart are 10% and 20 % by volume respectively. Determine the flux of diffusion of oxygen if nitrogen is non-diffusing. Total pressure : 101325 N/m², Temperature : 25°C and $D_{O2\text{-}N2}=2.042\times10^{-5}$ m²/s

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Discuss 'Fractional crystallisation' with suitable example. Describe briefly the various types of batch and continuous crystallizer that are used for industrial applications.

(b) Define *'Critical Moisture Content'*. A wet solid is to be dried from 35% to 10% moisture under constant drying conditions in 5 hrs. If the equilibrium moisture content is 4% and critical moisture content is 14%, how long it will take to dry solids to 6% moisture under the same conditions ?

(c) Explain the construction and operation of a spray dryer with the help of neat sketch. Also give the classification of dryers.

5. Write short notes on any **four** of the following : **(5×4=20)**

(a) HETP

(b) Henry's Law

(c) Application of Adsorption

(d) NTU & HTU

(e) Absorption in Packed column

(f) Ideal & Non ideal solutions.