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NBT402

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

PAPER ID : 154412

Roll No.

B.Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15

HEAT & MASS TRANSFER

Time : **3** Hours] [Total Marks : **100**

Note: Attempt ALL questions. Assume suitable data, if required. All question carry equal marks.

1 Attempt **any four** parts of the following:- **5×4**

(a) Differentiate between Free convection and Forced convection with suitable example.

(b) What do you mean by critical thickness of insulation? Explain with suitable example.

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

(d) Discuss Gray body & Black body with suitable examples.

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

(f) Explain thermal conductivity of a material with suitable examples.

2 Attempt **any two** parts of the following: **10×2**

(a) Crude oil flows at the rate of 1200 kg/hr through the inside pipe of a double pipe heat exchanger and is heated from 32°C to 92°C. The heat is supplied by kerosene initially at 205°C flowing through the annular space. If the temperature of approach (minimum temperature difference) is 10°C, determine the heat transfer area for co-current flow. Given that C*p* for crude oil=0.49 kcal/kc,°C, Cp for kerosene= 0.59 kcal/kg °C and Uo= 398 kcal/hr m^2 °C

(b) Discuss Kirchhoff s law. Also derive the expression for view factor calculation with suitable examples.

(c) Classify different types of diffusion. Explain the dependency of diffusion coefficient on temperature. Also discuss the Fick's law of diffusion with suitable example.

3 Attempt **any two** parts of the following:- **10×2**

(a) An open pan evaporator is being operated in batch mode. How the heat transfer coefficient does vary with time ? Also iscuss the empirical correlations used to estimate the heat transfer rates.

(b) Explain the penetration theory of mass transfer at fluid surfaces. Give the complete procedure for the determination of mass transfer coefficients with Suitable example.

(c) 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/m^2, Temperature :

25 °C and $D_{02\text{-}N2} = 2.042 \times 10^{-5}\ m_2/s$.

4 Attempt **any two** parts of the following:- **10×2**

(a) Describe the classification and applications of dryers. Also explain the Construction and operation of a spray dryer with the help of neat sketch.

(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) What is fractional crystallisation? Describe briefly the various types of batch and continuous crystallizer that are used for industrial applications.

5 Write short notes on any FOUR of the following: **5×4**

(a) Non ideal solutions

(b) Absorption in tray column

(c) Langmuir isotherm

(d) HETP

(e) Henry's Law

(f) Selection of solvents.