

Roll No.

Total No. of Pages : 02

Total No. of Questions : 08

B.E. (Sem.-2)
HEAT AND MASS TRANSFER

Subject Code : CH-502

Paper ID : [Z01014]

Time : 3 Hrs.

Max. Marks : 50

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carry TEN marks.

1. A 3.3 cm OD steel pipe, outside surface of which is at 500K, is surrounded by still air at 300K. The heat transfer coefficient by natural convection is $10\text{W/m}^2\text{K}$. It is proposed to reduce the heat loss to half by applying magnesia insulation ($k=0.07\text{ W/mK}$) on the outside surface of the pipe. Determine the thickness of insulation. Assume pipe surface temperature and convection heat transfer remains the same. (10)
2. a. Explain the concept of Planck distribution and Stefan-Boltzman Law.
b. Explain the terms “Black body” and “Grey body” with reference to radiant heat transfer. (5,5)
3. a. Derive an expression for LMTD for a double pipe counter current heat exchanger. Discuss the significance of the LMTD correction factor.
b. Give physical significance of
 - i) Grashof Number
 - ii) Prandtl number and
 - iii) Nusselt number
 - iv) Reynold’s number(5,5)
4. Compute the overall heat transfer coefficient based on the inner area for a glass tube having inside and outside diameter of 3 inch and 1.5 inches respectively. The average thermal conductivity of glass is $k = 0.8655\text{ W/ m K}$. The inner and outer surface coefficients are;
$$h_i = 2.84 \times 10^3\text{ W/ m}^2\text{ K}$$
$$h_o = 5.68 \times 10^3\text{ W/ m}^2\text{ K}$$
(10)

5.
 - a. Define Point efficiency, Murphree tray efficiency and column efficiency.
 - b. Write the steps to be followed in the design of packed columns. (5,5)
6. Explain drying curve. Planks of wood one inch thick are dried from an initial moisture content of 25% to a final moisture of 5%, using air of negligible humidity. If Diffusivity of moisture through solid D_v' for the wood is $3. \times 10^{-5} \text{ ft}^2/\text{hr}$, how long should it take to dry the wood? (10)
7.
 - a. Compare the performance of bubble-cap column, sieve-tray column and packed bed column. Discuss in detail the operation of any column.
 - b. Explain how the height of packing for an absorber can be calculated. (7,3)
8. A mixture of benzene and toluene containing 40 mole % of benzene is to be separated to give a product of 90 mole % of benzene at the top and bottom product with not more than 10 mole % of benzene. Using an average value of 2.4 for the volatility of benzene relative to toluene, calculate the number of theoretical plates required at total reflux. Also calculate the minimum reflux ratio, if the feed is liquid and at its boiling point. (10)