Total No. of Questions :8] *[Total No. of Printed Pages :2*

Roll No .....

ME-605

B.E. VI Semester

Examination, June 2017

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. A plane wall made of magnesite brick has its wall surface at 1200°C and 100°C. The thickness of the wall is 0.3m and its thermal conductivity varies linearly as K = 4.13 (1+0.0004576 T) W/mK. where T is in °C. Calculate the location in the wall where the temperature will be 800°C. If the variation of the thermal conductivity is ignored and it is assumed that K = 4.13W/mK, then calculate the new location at the temperature of 800°C.

2. A concrete slab 80mm thick (K=1.37 W/mK) is to be placed between two 5mm thick metallic (K = 43W/mK) plates. Both faces of concrete slab adjacent to the plates have rough solid to solid contact over 25% of the area. Where the average height of the roughness are 2 mm. Assuming that the cavity area is filled with air (K = 0.0263W/mK) find the rate of Heat Transfer per unit area if the outer surface temperature of the plates are 500°C and 100°C respectively.

19

3. A copper rod of 10mm diameter and 0.4m long is firmly connected to two walls, maintained at 200°C and 150°C. If the rod is allowed to dissipate heat to the atmospheric air at 30°C having heat transfer coefficient of 12 W/m^2°C estimate the net heat loss from the rod to the air, also find the maximum temperature in the rod and its location.

4. Deduce equations of Heat transfer rate and temperature distribution for a fin with infinite length take a pin fin for this analysis.

5. Atmospheric air enters a 6mm diameter tube at 300°K with a velocity of 2 m/s and leaves at 350°K. If the tube length is 1m, calculate the Heat transfer rate and tube wall temperature as well as the heat transfer coefficient at the exit.
Properties of air at butt temperature of 325°K are as below –
$\rho = 1.086 kg/m^3$, $\nu = 18.8 \times 10^{-6}$ m^2/s, Pr = 0.703, K = 0.02814 W/m°K, Cp = 1.0076 KJ/kgK

6. Deduce an equation in terms of dimensionless numbers for natural correction Heat transfer using Buckingham π theorem.

7. Deduce LMTD equation for parallel flow Heat Exchangers.

8. Answer any four of the following:
   a) Deduce critical radian of insulation equation for a composite cylinder.
   b) How and why error occurs in measurement of temperature in a thermometer wall?
   c) Discuss Reynolds number, Prandtle Number and Nusselt Number.

   d) Explain Fick's law of Mass transfer.
   e) What is slope factor?
   f) Discuss plank's distribution law.

20 ******