Exam.Code:0942
Sub. Code: 33875

2055
B.E. (Mechanical Engineering)
Sixth Semester
MEC-604: Heat Transfer

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

1 a How does the heat conduction differ from convection? 10
b Write equation for resistance offered by a hollow sphere of radii r_1, r_2 and constant thermal conductivity.
c what is the physical significance of Prandtl Number?
d State Planck's distribution law.
e Define effectiveness of heat exchanger.

Part -A

2 Derive general heat conduction equation in rectangular coordinates system. 10

3 The walls of a house, 4 m high, 5 m wide and 0.3 m thick are made from brick with thermal conductivity of 0.9 W/m. K. The temperature of air inside the house is 20°C and outside air is at –10°C. There is a heat transfer coefficient of 10 W/m^2. K on the inside wall and 30 W/m^2. K on the outside wall. Calculate the inside and outside wall temperatures, heat flux and total heat transfer rate through the wall. 10

4 If a thin and long fin, insulated at its tip is used, show that the heat transfer from the fin is given by 10

$$Q_{FIN} = \sqrt{hPLA_c}\,(T_0 - T_\infty)\tan(mL)$$

<u>Part- B</u>

5 a State and explain Stefan Boltzmann law. 3
b Calculate the overall heat transfer coefficient based on outer surface of a steel pipe (k = 54 W/m. K) with inner and outer diameters as 25 mm and 35 mm respectively. The inside and outside heat transfer coefficients are 1200 W/m^2. K and 2000 W/m^2. K respectively. 7

6 Show that 10

$$F_{12} = \frac{1}{A_1}\iint_{A_1A_2}\frac{\cos\beta_1\cos\beta_2}{\pi s^2}\,dA_1\,dA_2$$

7 a Differentiate between condensation and boiling heat transfer? 5
b List the relevant dimensionless terms that govern forced convection. Give their physical significance. 5

x-x-x