24.

Exam.Code:1014
Sub. Code: 7752

1128

M. E. (Mechanical Engineering)
First Semester
MME-104: Advanced Heat Transfer

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

NOTE: Attempt five questions in all, selecting atleast two questions from each Part.

x-x-x

Part-A

1) a. Find the equation for heat flow and temperature distribution for a fin of arbitrary geometry. 8
   b. What is meant by transient heat conduction? 2

2) a. What are Heisler Chart's? 2
   b. In a rectangular region where transient heat transfer in x and y direction is important, develop the finite difference equations for interior nodes and boundary nodes. 8

3) a. A slab of aluminium 15 cm thick is originally at a temperature of 450° C. It is suddenly immersed in a liquid at 100° C resulting in a heat transfer coefficient of 1100 W/m^2K. What is the value of temperature at the canter line and the surface 1m after the immersion? Also calculate the total thermal energy removed per unit area of the slab during this period. The properties of aluminium for the given condition are 7
   $\alpha = 8.4 \times 10^{-5}\ m^2/s$ $k = 215\ W/mK$ $\rho = 2700 kg/m^3$ $c = 0.9\ kJ/kg/K$
   b. Explain the the following: 3
   a)Planks Law of radiation b) Lamberts cosine law c) Radiation of luminous gas flame.

4) a. Two large parallel planes are at 1000 K and 600 K. Determine the heat exchange per unit area. (i) if surfaces are black (ii) if the hot one has an emissivity of 0.7 and the cooler one 0.4 (iii) if a large plate is inserted between these two, the plate having an emissivity of 0.2. 5
   b. Prove that intensity of radiation decreases exponentially with thickness as travels through the gas layer. 5

Part-B

5) Derive the relation for local heat transfer coefficient by Von Karman integral technique for the boundary layer over a flat plate. 10

6) For fully developed, steady, laminar flow in pipe, find the equation for pressure drop and volumetric flow rate. 10

7) Concentration distribution in spherical shell is a function of radius r. Derive the relation for concentration distribution for above said case. 10

8) a. Consider a binary mixture of species B and C. Deduce the relation for diffusion coefficients in equimolal counter diffusion in gases. 7
   b. Define : molar fraction, mass fraction and modes of mass transfer 3

x-x-x