Roll No. .....

1088

B. E. 6th Semester (Mech. Engg.)

Examination – December, 2010

HEAT AND MASS TRANSFER

Paper : ME-306-C

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any *five* questions in all, selecting at least *two* question from each Section. Use of steam tables, charts and graphical plots are permitted.

SECTION – I

1. (a) Explain with example the importance of heat transfer in various field of engineering. 10

   (b) What is different between natural and forced convection ? Does any convection process involve conduction to some extent ? 10

2. (a) Derive 3-D heat conduction equation in spherical coordinates. 12

(b) Derive an expression for heat flow through a composite cylinder taking into account the film heat transfer coefficient on the inside and outside surface of the cylinder. 8

3. (a) Set up expressions for temperature distribution during steady state heat conduction in a solid sphere with internal heat generation. 10

(b) Derive the relation for heat dissipation from a fin insulated at the tip. 10

4. (a) A large disc of 15 cm thickness is initially held at 200 C and then suddenly exposed to ambient conditions at 20 C temperature. What would be the temperature at the centre of the disc 10 minutes after this change? The following properties are given : 10

$K = 48.7\ W/m\ K;\ \rho = 1600\ Kg/m^3\ cp = 1046\ J/Kgk;\ h = 23.5\ W/m^2K.$

(b) Explain a method to obtain solutions to the problem of transient heat conduction in infinitely thick solids. 10

SECTION – II

5. (a) Calculate the average Nusselt number for turbulent flow over a flat plate where a transition occurs abruptly when the local Reynolds number is 4×10^5. 10

(b) Obtain the relation between the heat transfer coefficient and the friction coefficient. 10

6. (a) Air flow between two concentric cylindrical gray surfaces; the relevant geometrical and thermodynamic parameters are : 14

Diameters: 40 mm and 100 mm

Absorptivities: 0.75 and 0.85

Temperatures: 440 K and 870 K

At a given point, the temperature of air is 750 K. Compare the rate of radiant heat transfer to the inner surface with the convective heat transport at that point. Assume that convective coefficient h = 125.6 K J/m^2-hr-deg and radiation constant is 5.67 X 10^{-8} W/m^2 K^4.

(b) State and prove kirchoff's law for heat radiation. 6

7. (a) Derive the relationship between the effectiveness and number of transfer units for a counter flow heat exchanger. 14

(b) What is heat exchanger ? How heat exchangers are classified ? 6

8. Write short notes on : 5 × 4

(a) Pool boiling

(b) Nucleate boiling

(c) Drop wise condensation

(d) Boiling regimes.
