[03 – 4102]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

HEAT AND MASS TRANSFER

(Common with Mechanical, M.P. and I.E and Metallurgical Engineering)

(Effective from the admitted batch of 1999–2000)

Time : Three hours Maximum : 70 marks

Answer question No.1 and answer any FOUR questions from the remaining questions.

Assume suitable missing data wherever necessary.

Answer to question No. 1 must be at one place.

All questions carry equal marks.

Heat Transfer data book permitted.

1. (a) Why the conductivity of metals decreases and the conductivity of insulating material increases with increase in temperature.

   (b) Explain the thermal conductance and thermal resistance.

   (c) What are the demerits of fouling factor?

(d) Differentiate between the natural and forced convection.

(e) What is thermal radiation?

(f) Define the heat capacity ratio.

(g) Define the mass transfer.

2. (a) Derive general conduction equation in Cartesian coordinates and deduce it to one dimensional steady state condition with no internal heat generation.

(b) Define thermal conductivity and name some good conductors and some poor conductors of heat.

3. (a) Give the boundary conditions for longitudinal fins in the following cases (i) fin of infinite length (ii) fin of finite length with ends not insulated and (iii) fin of finite length with ends insulated.

(b) What are the assumptions made by Newman to generalize the results for unsteady state mass transfer?

4. (a) What is the significance of Reynolds, Pradtl, Grashoffs and Nusselts numbers?

(b) Calculate the heat transfer from a 60W incandescent bulb at 115°C to ambient air at 25°C. Assume the bulb as a sphere of 50 mm diameter. Also, find the percentage of power lost by free convection.

5. State and explain the following laws relating to temperature of a radiating body:
   (a) Plank's law
   (b) Stefan Boltzman law
   (c) Wien's displacement law

6. (a) Derive an expression for LMTD of a parallel flow heat exchanger. State the assumptions you have made.
   (b) A hot fluid at 200°C enters a heat exchanger at a mass flow rate of 10^4 kg/h. Its specific heat is 2000 J/kg K. It is to be cooled by another fluid entering at 25°C with a mass flow rate 2500 kg/h and specific heat 400 J/kg K. The overall heat transfer coefficient based on outside area of 20 m^2 is 250 W/m^2 K. Find the exit temperature of the hot fluid when he fluids are in parallel flow.

7. (a) Distinguish between nucleate and film boiling.
   (b) Distinguish between film wise and drop wise condensation. Which of the two gives a higher heat transfer coefficient? Why?

8. Write short notes on following.
   (a) Fick's law of diffusion
   (b) Diffusion of gases
