Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (ME) (Sem.–5)

HEAT TRANSFER

Subject Code : ME-303

Paper ID : [A0815]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

I. Answer briefly :

a) State Fourier's Law of Heat Conduction.

b) How does heat transfer differ from the thermodynamics?

c) Define the terms Irradiation and Radiosity.

d) Define conduction Shape Factor.

e) Differentiate between free and forced convection.

f) Define Wein's displacement law of radiation.

g) Define the Staton Number.

h) Differentiate between thermal and hydrodynamic Boundary Layers.

i) What is the difference between Fin Efficiency and Fin Effectiveness?

j) What is the difference between friction factor and coefficient of friction?

SECTION-B

2) A horizontal plate ('k' = 30 W/m K) 600 m maintained at 300°C. The air at 30°C flov convection coefficient of air over the plate is is lost from the plate by radiation. Calculate the of the plate.

3) (a) A 3.2 mm diameter stainless steel wire, 3 10V impressed on it. The outer surface t maintained at 93°C. Calculate the centre Take the resistivity of the wire as 70 micr conductivity as 22.5W/(m.K).

(b) The heated wire in the above case (a) maintained at 93°C. The convection he 5.7 kW/m²K. Calculate the centre temperat

4) The steam at 300°C is passing through steel t of steel (k=45 W/m K) of inside diameter 1 used to measure the temperature. Calculate t pocket needed to measure the temperature witl The diameter of steam tube is 95 mm. Take h 93 W/m².K and tube wall temperature as 100°

5) A 50 cm × 50 cm copper slab, 6 mm thick, a 350°C, suddenly has its surface temperature time at which the slab temperature b ρ = 9000 kg/m³ C_p = 0.38 kJ/(kg K), k = 370 Also, find out the rate of cooling after 60 seco

6) Discuss the conditions under which the drop v place. Why the rate of heat transfer in drop v times that of film wise condensation?

SECTION-C

7) Derive 3-D General Heat Conduction Equation in Cartesian Co-ordinate system.

8) A paint baking oven consists of a long triangular duct in which a heated surface is maintained at 1200 K and another surface is insulated. Painted panels, which are maintained at 500 K, occupy the third surface. The triangle of width of 1m on a side, and heated and insulated surfaces have an emissivity of 0.8. The emissivity of the panels is 0.4. During steady state condition, at what rate must energy be supplied to the heated side per unit length of duct to maintain its temperature at 1200 K? What is the temperature of insulated surface?

9) A counter flow heat exchanger is used to heat water from 20°C to 80°C at a rate of 1.2 kg/s. The heating is obtained by using geothermal water available at 160°C at a mass flow rate of 2 kg/s. The inner tube is thin walled, and has a diameter of 1.5 cm. If the overall heat transfer coefficient is 640 $W/m^2.K$. Calculate the length of the heat exchanger required to achieve the desired heating by using **effectiveness-NTU method**. Take specific heat of geothermal water as 4.31 kj/kg K and that of ground water as 4.18kJ/kg K.