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Total No. of Pages : 02

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B.Tech. (ME) (2011 Onwards) (Sem.–6)

HEAT TRANSFER

Subject Code : BTME-602

M.Code : 71186

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS 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 have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) State Stefan – Boltzman law.

b) Define transient state of heat transfer.

c) What is meant by contact thermal resistance?

d) What type of boundary conditions is used at the fin edge?

e) What is the utility of extended surface?

f) Differentiate between laminar and turbulent flow.

g) Define thermodynamic boundary layer thickness.

h) What do you understand by nucleation?

i) Define absorptivity.

j) What is meant by radiation shield?

SECTION-B

2. Distinguish between conduction, convection and radiation modes of heat transfer.

3. State the effect of impurities on the thermal conductivity of a material.

4. Compute the heat loss per square meter surface area of a 40 cm thick furnace wall having surface temperature of 300°C and 50°C, if the thermal conductivity k of the wall material is given by,

$$k = 0.005T - 5 \times 10^{-6}T^2 \text{ ; where T = temperature in °C}$$

5. Air at 20°C flows over a flat plate maintained at 75°C. Measurements show that temperature at a distance of 0.5 mm from the surface of plate is 50°C. Presuming thermal conductivity of air as 0.0266 W/m-deg, estimate the value of local heat transfer coefficient.

6. A thermos flask has a double walled bottle and the space between the walls is evacuated so as to reduce the heat flow. The bottle surfaces are silver plated and the emissivity of each surface is 0.025. If the contents of the bottle are at 375 K, find the rate of heat loss from the thermos bottle to the ambient air at 300 K. What thickness of cork (k = 0.03 W/m-deg) would be required if the same insulating effect is to be achieved by the use of cork?

SECTION-C

7. The door of a domestic refrigerator has an area of 0.7 m^2 and it basically consists of a thin metal sheet with a 25 mm thick layer of insulation on the inside. The thermal conductivity of this insulation is 0.25 W/m-deg and heat transfer on each side of the door is 10 W/m^2-deg. Determine the heat flow rate through the door and the temperature of the metal sheet. The refrigerated chamber and the room are at 0°C and 20°C respectively. Neglect thermal resistance due to the sheet metal.

8. A rod of 10 mm diameter and 80 mm length with thermal conductivity 16 W/m-deg protrudes from a surface at 160°C. The rod is exposed to air at 30°C with a convection coefficient of 25 W/m^2-deg. How does the heat flow from this rod get affected if the same material volume is used for two fins of the same length? Assume short fin with end insulated.

9. Air flow through a long rectangular (30 cm height × 60 cm width) air conditioning duct maintains the outer surface temperature at 15°C. If the duct is uninsulated and exposed to air at 25°C, calculate the heat gained by the duct per meter length, assuming it to be horizontal.

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC against the Student.