Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ME) (2011 onwards) (Sem.–6)

HEAT TRANSFER

Subject Code : BTME-602

Paper ID : [A2362]

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

1. **Write briefly :**

(a) What is Conduction Shape Factor?

(b) Define Thermal Conductance and Thermal Resistance.

(c) Differentiate between fin effectiveness and fin efficiency.

(d) Define forced and free convection. Give one example of each.

(e) Write the significance of Biot number.

(f) State the term burnout point.

(g) Define regenerator & recuperator.

(h) Classify the terms absorptivity and transmissivity.

(i) Define Lambert's Cosine Law of Radiation.

(j) *Air is bad conductor of heat then how temperature of air rises in summers?*

SECTION - B

2. Derive the three-dimensional general conduction equation in Cartesian co-ordinate.

3. A carbon steel rod (k=55W/m-deg) has been attached to a plane wall, which is maintained at a temperature of 350°C. The rod is 8 cm long and has the cross-section of an equilateral triangle with each side 5 mm. Determine the heat dissipation from the rod if it is exposed to a convection environment at 25°C with unit surface conductance 100 W/m^2-deg. Consider end surface loss to be negligible.

4. What do you understand by the hydrodynamic and thermal boundary layers? Illustrate with reference to flow over a flat heated plate.

5. State and explain the following laws relating to thermal radiation and temperature of a radiating body :

   (i) Planck's law (ii) Stefan Boltzman law and Wien's displacement law

6. Explain the phenomenon of nucleate boiling. List the factors that affect nucleate boiling.

SECTION - C

7. Exhaust gases (Cp=1.12 KJ/Kg-K) flowing through a tubular heat exchanger at the rate of 1200 Kg/hr are cooled from 400°C to 120°C. The cooling is affected by water (Cp= 4.18 KJ/Kg-K) that enters the system at 10°C at the rate of 1500 Kg/hr. If the overall heat transfer coefficient is 500 KJ/m^2-hr.deg. What heat exchanger area is required to handle the load for

   (a) Parallel flow and

   (b) Counter flow arrangement?

8. Distinguish between the configuration factor and the interchange factor, Determine the radiation heat flux between two closely spaced black parallel plates radiating only to each other if their temperatures are 850 k and 425 K respectively. Recalculate the heat flux presuming that each of the parallel plates has an emissivity of 0.5. In each case plates have an area of 4 m^2.

9. Write short note on :

   (a) Critical radius of insulation

   (b) Fourier's law of heat conduction