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

Total No. of Questions : 09

B.Tech. (Mechanical Engg.) (Sem.–5)

HEAT TRANSFER

Subject Code : BTME-501-18

M.Code : 78247

Date of Examination : 17-11-2023

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. **Answer briefly :**

   a) How does heat transfer differs from thermodynamics?

   b) What is logarithmic mean area for a hollow sphere?

   c) Define efficiency of a fin.

   d) Explain the physical significance of Fourier's number.

   e) How will you define the characteristic length of a horizontal plate?

   f) In a forced convection heat transfer application, the Nusselt number is 4.36, thermal conductivity is 0.628 W/m — K and the diameter of the tube is 0.03 m. Find heat transfer coefficient.

   g) What is flow boiling?

   h) What does the term effectiveness mean in heat exchanger analysis?

   i) Define radiation intensity.

   j) What is radiation shape factor?

SECTION-B

2. Derive one dimensional time dependent heat conduction equation with internal heat generation and variable thermal conductivity in Cartesian coordinate system.

3. A long rod 12 mm square section made of low carbon steel protrudes into air at 35°C from a furnace wall at 200°C . The convective heat transfer coefficient is estimated at $22 W/m^2 – K$. The conductivity of the material is 51.9 W/m – K. Determine the location

from the wall at which the temperature will be 60°C. Also calculate the temperature at 80 mm from base.

4. The local Nusselt number in the case of rough plate was correlated to give

$$Nu_x = 0.04\,Re_x^{0.9}\,Pr^{1/3}$$

Determine the average value upto a length L.

5. Discuss the Film-wise condensation. What are the assumptions made, while analyzing Film-wise condensation on a vertical plate?

6. The effective temperature of a body having an area of 0.10 m^2 is 550°C. Calculate, a) the total rate of energy emission, b) the intensity of total radiation, c) the wavelength of maximum monochromatic emissive power.

SECTION-C

7. Derive three dimensional heat conduction equation in Cartesian coordinates.

8. The inlet and outlet temperature of hot and cold fluids in a double pipe heat exchanger are 220°C, 100°C and 80°C and 120°C. Determine whether the exchanger is parallel flow or counter flow. Also determine the LMTD and effectiveness of the exchanger and the capacity ratio.

9. What do you mean by radiation shield? Show that :

$$\left(\frac{Q}{A}\right)_{\text{with N shields}} = \frac{1}{N+1}\left(\frac{Q}{A}\right)_{\text{without shields}}$$

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.