

BT -5/ D-19
HEAT TRANSFER
Paper-ME-305N

Time allowed : 3 hours]

[Maximum marks : 75

Note:- Attempt five questions in all selecting at least one question from each unit. All questions carry equal marks.

Unit-I

1. (a) Define and distinguish between (i) steady state, (ii) unsteady state, and (iii) transients state of heat transfer. 6
- (b) A solar panel, 1m x 1.25m receives solar radiation 1500 watts. Calculate surface temperature of the panel if the ambient temperature is 25°C and the convective heat transfer coefficient of the air film over the surface of panel is 12.5W/m²-deg. 9
2. (a) Define thermal diffusivity and explain its physical significance. 5
- (b) State and explain different types of boundary condition applied to heat conduction problems. 10

Unit-II

3. (a) Differentiate between mechanisms of heat transfer by free and forced convection. 5

(2)

- (b) A plate 60 cm high and 30 cm wide, having a surface temperature at 35°C, is in contact with air at 20°C. If the observed convective heat transfer rate is 45W for each side, compute the average convection coefficient. 10

4. A steel pipe, 20cm diameter and 15m long, carrying hot gas at 300°C is placed in still air at 25°C. Determine the heat loss by natural convection if the convective heat transfer coefficient is approximated by the relation.

$$h = 1.32 \left(\frac{\Delta t}{d} \right)^{1/4} \text{ w/m}^2\text{-deg where } d \text{ is in meters and } \Delta t \text{ is in degrees Kelvin.}$$

15

Unit-III

5. A black body in the form of cube 1m long on the side has a temperature 1000k. Find the radiant energy flux density and the total energy emitted by the black body cube. 15
6. A stainless steel plate ($\epsilon = 0.6$) at 100°C faces a brick wall ($\epsilon = 0.75$) at 500°C. Estimate the heat flux and the radiant heat transfer coefficient. 15

Unit-IV

7. (a) How does a fin enhance heat transfer at a surface? 4
- (b) What are the various types of fins? 5

(3)

- (c) Enumerate the various assumptions made in the formation of energy equation for one-dimensional heat dissipation from an extended surface. 6
8. (a) What is a heat exchanger? How heat exchangers are classified? 5
- (b) Discuss the importance of heat exchangers for industrial use. 3
- (c) Sketch a two-shell pass, four tube pass, reversed current heat exchanger. Label the different parts. 7