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

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) Define Thermal conductivity. What is the effect of temperature on it?

b) What is meant by critical thickness of insulation? How it is calculated in case of sphere?

c) Define Lambert's cosine law of radiation.

d) What is the significance of fin efficiency and fin effectiveness?

e) Draw temperature profile of a parallel-flow heat exchanger.

f) What is reciprocity theorem?

g) Differentiate Nusset number and Biot number.

h) Define Overall heat transfer co-efficient.

i) Enlist different types of condensation.

j) Define black body.

SECTION-B

2. Derive 3-dimensional momentum equation for the hydrodynamic boundary layer on a flat plate.

3. Set up expression for three dimensional equation of temperature distribution during steady state heat conduction in a solid cylinder with internal heat generation.

4. Derive relation of emissive power for small body in large enclosure.

5. Heat transfer coefficient depends upon the parameters such as fluid viscosity, thermal conductivity, specific heat, length/diameter and ($\beta g \Delta t$). By using dimensional analysis establish the correlation.

6. Derive the expression for LMTD of counter flow heat exchanger.

SECTION-C

7. If a fin is thin and long and tip loss is negligible, show that the heat transfer from the fin is given by $Q_{fin} = \sqrt{h P k A_c}\ (t_0 - t_f) \tanh\left(\sqrt{\frac{hP}{kA_c}}.l\right)$.

8. Air at 15°C flows at a velocity of 6.5 m/s over a flat plate. The plate surface is at a temperature of 60°C. Assuming that the transition occurs at a critical Reynolds no. of 5×10^5, find the distance from the leading edge at which the boundary layer changes from laminar to turbulent. At the location, calculate the following :

   (a) Thickness of hydrodynamic boundary layer.

   (b) Thickness of thermal boundary layer.

   (c) Local & average convective heat transfer coefficients.

   (d) Heat transfer rate from both sides per unit width of plate.

9. Write short notes on :

   (a) Heat exchanger effectiveness and number of transfer units (NTU)

   (b) Intensity of radiation and solid angle.

   (c) Different theories of nucleation.