Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (Mechanical Engineering) (Sem.–5)

HEAT TRANSFER

Subject Code : ME-303

M.Code : 59022

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 diffusivity.

b. What is overall heat transfer coefficient?

c. Define Biot number and their significance?

d. Define fin effectiveness?

e. Define Newtons law of cooling?

f. What is Lambert's Cosine law?

g. What do you mean by drop wise condensation and film wise condensation?

h. Define the terms irradiation and radiosity?

i. What is Planck's law of thermal radiation?

j. Draw the temperature profile for parallel flow and counter flow heat exchangers?

SECTION-B

2. What are three modes of heat transfer, explain with suitable examples.

3. A steel rod (k = 30 W/m °C), 10 mm in diameter and 50 mm long with an insulated end is to be used as a fin. It is exposed to surrounding with temperature of 65°C and heat transfer coefficient 50 W/m^2 °C. The temperature at base is 98°C. Determine

   a. fin efficiency

   b. temperature at the end of fin.

4. What are different boundary conditions used for solution of heat transfer problems? Write the expression for each of them.

5. A black body of 0.2 m^2 area has an effective temperature of 800°K. Calculate

   a. The total rate of energy emission ($\sigma_b = 5.67 \times 10^{-8}$ W/m^2 - K^4)

   b. The energy of normal radiation

   c. The intensity of radiation along a direction 60° to the normal.

6. What are the common causes of fouling in heat exchangers? How does fouling affects heat transfer and pressure drop.

SECTION-C

7. Derive an expression for logarithmic mean temperature difference (LMTD) in counter flow heat exchanger.

8. A counter flow heat exchanger is used to heat water from 20°C to 80°C at a rate of 1.2 kg/s. The heating is obtained by using geothermal water available at 160°C at a mass flow rate of 2 kg/s. The inner tube is thin walled, and has a diameter of 1.5 cm. If the overall transfer coefficient is 640 W/m^2 K. Calculate the length of the heat exchanger required to achieve the desired heating by using effectiveness - NTU method. Take specific heat of geothermal water as 4.31 KJ/Kg K and that of ground water as 4.18 KJ/Kg K.

9. Explain the following :

   a. What is the utility of the extended surfaces?

   b. What is black body? Write the significant of defining the black body.

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.