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

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.–5)

HEAT TRANSFER

Subject Code : BTAE-503

Paper ID : [A2063]

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 :

1. Differentiate between fin efficiency and fin effectiveness.
2. List down the three types of boundary conditions.
3. Define Nusselt number and Stanton number.
4. Define thermal diffusivity and explain its physical significance.
5. How are heat exchangers classified based on flow arrangement?
6. Why are the convection and the radiation resistances at a surface in parallel instead of being in series?
7. How does the Grashoff number differ from the Reynolds number?
8. What is the critical radius of insulation? How is it defined for a cylindrical layer?
9. State the Kirchoff's law of radiation.
10. What do you mean by energy balance in heat transfer of IC engines?

SECTION - B

2) Explain the different modes of heat transfer with appropriate expressions.

3) Define Reynold's, Nusselt and Prandtl numbers.

4) Write a short note on temperature distribution and stresses in piston of IC engines.

5) The temperature of a body of area 0.1 m^2 is 900 K. Calculate the total rate of energy emission, intensity of radiation in $W/(m^2 sr)$, maximum monochromatic emissive power and wave length at which it occurs.

6) Derive the relation for critical thickness of insulation for pipes.

SECTION - C

7) Hot oil with a capacity rate of 2500 W/K flows through a double pipe heat exchanger. It enters at 360 °C and leaves at 300 °C. Cold fluid enters at 30 °C and leaves at 200 °C. If the overall heat transfer coefficient is 800 W/m^2 K, Determine the heat exchanger area required for :

   a) Parallel flow

   b) Counter flow 10

8) Starting from basic derive the equation for heat dissipation and temperature distribution by a fin with an insulated tip 10

9) a) Prove that intensity of radiation $(I_b) = (1/\pi)E_b$ where E_b is emissive power of black body. 4

   b) Derive the 3-D general conduction equation in rectangular coordinates. 6