INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech VI Semester End Examinations (Regular), November – 2020
Regulation: IARE–R16
HEAT TRANSFER

Time: 2 Hours   (ME)   **Max Marks: 70**

Answer any Four Questions from Part A
Answer any Five Questions from Part B

PART – A

1. What are different modes of heat transfer and explain the mechanism of each? **[5M]**

2. What is the physical significance of Fourier number and Biot number? **[5M]**

3. Draw the velocity and thermal boundary layers for a flow through tube. **[5M]**

4. Explain about drop wise and film wise condensation. **[5M]**

5. Why is a counter flow heat exchanger more efficient than a parallel flow exchanger? **[5M]**

6. Does any of the energy of the sun reach the earth by conduction or convection? Explain. **[5M]**

7. Distinguish between steady state conduction and unsteady state conduction. **[5M]**

8. What are the advantages of dimension analysis for the convection equations? **[5M]**

PART – B

9. Determine general three dimensional heat conduction equation in Cartesian coordinate system. **[10M]**

10. What is radiation heat transfer coefficient and deduce the correlation for it? **[10M]**

11. Obtain an equation to determine the critical radius of insulation for a cylinder? **[10M]**

12. A hollow steel tube of k = 15 W/mK having inside and outside diameters respectively equal to 5 cm and 7.6 cm. It is provided with insulation of thermal conductivity 0.2 W/mK and thickness 0.2 cm. Flue gases at temperature 330°C flow through the tube offering convection heat transfer coefficient 400 W/m^2K. The outside surface is exposed to the ambient at 30°C offering convection heat transfer coefficient 60 W/m^2K. Calculate the rate of heat transfer if it is 10 m long. Also determine the interface temperatures? **[10M]**

13. Prove that the Nusselt number of a natural convection heat transfer is function of Grashof and Prandtl number?

       [10M]

14. What is Rayleigh number? Discuss the nature of flow with respect to it. **[10M]**

15. Distinguish between film wise and drop wise condensation. Which of the two does give a higher heat transfer coefficient? Why? **[10M]**

16. What is the Stefan-Boltzmann Law? Explain the concept of total emissive power of a surface. **[10M]**

17. What is fouling in heat exchangers? Explain the sources and ill effects of fouling? **[10M]**

18. In a counter flow double pipe heat exchanger, water is heated from 25^0C to 65^0C by oil with a specific heat of 1.45kJ/kg-K and mass flow rate of 0.9kg/s. the oil is cooled from 230^0C to 160^0C. If overall heat transfer coefficient is 420W/m^2 -K. Calculate the rate of heat transfer, mass flow rate of water and surface area of heat exchanger. **[10M]**

$- \circ \circ \bigcirc \circ \circ -$