Code No: **R1631245** **R16** SET - 1

**III B. Tech I Semester Supplementary Examinations, August – 2021**

**HEAT TRANSFER**

(Automobile Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**
(Heat transfer data book allowed)

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**PART –A** **(14 Marks)**

1. a) Explain Fourier rate equation. [2M]
   b) Give a brief note on fin with insulated tip. [2M]
   c) Briefly explain continuity equation. [2M]
   d) Discuss about the dimensionless numbers in free convection. [3M]
   e) What is the significance of overall heat transfer coefficient? Explain. [3M]
   f) Explain about Radiosity with a sketch. [2M]

**PART –B** **(56 Marks)**

2. a) A spherical container of negligible thickness holding a hot fluid at $140^0$ C and having an outer diameter of 0.4 m is insulated with three layers of each 50 mm thick insulation of k1 = 0.02, k2 = 0.06 and k3=0.16W/mK.(Starting from inside). The outside surface temperature is $30^0$C. Determine: i) the heat loss, and ii) Interface temperatures of insulating layers. [7M]
   b) Derive the expression for the critical radius of insulation for a sphere. [7M]

3. a) A motor body is 360 mm in diameter (outside) and 240 mm long. Its surface temperature should not exceed $55^0$C when dissipating 340W. Longitudinal fins of 15 mm thickness and 40 mm height are proposed. The convection coefficient is 40W/$m^2$ $^0$C. Determine the number of fins required. Atmospheric temperature is $30^0$C and thermal conductivity = 40 W/m $^0$C. [9M]
   b) Explain the significance of Biot and Fourier numbers. [5M]

4. a) Determine an expression for free convection by Buckingham's Pi theorem assuming h = f {ρ, L, μ, Cp, k, β g ΔT}. [9M]
   b) Explain the prominence of any three non-dimensional numbers. [5M]



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5. a) With a neat sketch explain the development of hydrodynamic and thermal boundary layers in internal flow. [7M]
   b) Air flows through long rectangular heating duct of width and height of 0.75m and 0.3 m respectively. The outer surface temperature of the duct is maintained at $45^0$C. If the duct is exposed to air at $15^0$C in a cramp-free beneath a home, what is the heat loss from the duct per meter length? [7M]

6. a) Explain the regimes of pool boiling with a neat sketch. [7M]
   b) Water flows at the rate of 65 kg/min through a double pipe counter flow heat exchanger. Water is heated from $50^0$ C to$75^0$ C by oil flowing through the tube. The specific heat of the oil is 1.780 kj/kg.K. The oil enters at $115^0$C and leaves at $70^0$C. The overall heat transfer co-efficient is 340 W/m$^2$K. Calculate the following: [7M]
      i) Heat exchanger area and ii) Rate of heat transfer.

7. a) The filament of a 75 W light bulb may be considered as a black body radiating into a black enclosure at $70^0$ C. the filament diameter is 0.10 mm and length is 5 cm. considering the radiation, determine the filament temperature. [7M]
   b) There are two large parallel plane with emissivities 0.3 and 0.8 exchange heat. Find the percentage reduction when an aluminum shield of emissivity 0.04 is placed between them. Use the method of electrical analogy. [7M]

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