Code :R7310306 **R7**

III B.Tech I Semester(R07) Supplementary Examinations, May 2011
HEAT TRANSFER
(Mechanical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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1. (a) Define thermal resistance and thermal conductance.
   (b) Define thermal conductivity and explain how thermal conductivity varies with temperature in solids, liquids and gases.

2. (a) A round rod of 10mm diameter and 300mm long is firmly fixed between two heat sources maintained at 125^0C. If the conductivity of the rod is 45 W/m-K and film heat transfer coefficient is 7 W/m^2 .K. Estimate the temperature at the middle of the rod and the heat loss from the rod per unit time.
   (b) Derive expressions for heat flow and temperature distribution for a rectangular fin of infinite length.

3. A solid copper cylinder of 5 cm diameter was dropped into ice water after recording the temperature as 20 ^{0}C. After 3 minutes the temperature of the cylinder is again measured and recorded as 1 ^{0}C. Calculate the corrective heat transfer coefficient by taking density and specific heat of copper as 8600 Kg/m^3 and 334.94 J/Kg-K respectively. Neglect the thermal resistance of the cylinder.

4. (a) Air flowing through a long tube of 2.5cm diameter at a flow rate of 30m/s is heated from an entry temperature of 20 ^{0}C to an exit temperature of 40^0C, while the temperature of the tube is maintained at 50 ^{0}C. Estimate the heat transfer coefficient between the air and the inner tube.
   (b) Describe the physical mechanism of convection. How is the convection heat-transfer coefficient related to the mechanism?

5. (a) What do you mean by critical value of Rayleigh number?
   (b) A vertical pipe of 10 cm outer diameter, at a surface temperature of 100 ^{0}C is in room where the air is at 20 ^{0}C. The pipe is long. What is the rate of heat loss per meter length of the pipe?

6. (a) How is the Reynolds number in condensation defined? What is its critical value?
   (b) A vertical plate 2.8m high is maintained at 54^0C in the presence of a saturated steam at atmospheric pressure. Estimate the heat transfer rate per unit width.

7. (a) Starting from fundamentals, Derive an expression for the LMTD of a counter - flow heat exchangers in terms of inlet and outlet temperatures of hot and cold fluids.
   (b) Saturated steam at 120^0C is condensed on the other tube surface of a single pass heat exchanger. The heat transfer coefficient is 1800 W/m^2K. Determine the surface area of a heat exchanger capable of heating 1000Kg/h of water from 20^0C to 90^0C. Also compute rate of condensation of steam.

8. (a) State Planck's law of monochromatic radiation. What is its signification?
   (b) Two black square plate of size 1.0 by 1.0 m are placed parallel to each other at a distance of 0.4m. One plate is maintained at a temperature of 900^0C and the other at 400^0C. Find net exchange of energy due to radiation between the two plates.

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