Code: 9A03505

R09

B.Tech III Year I Semester (R09) Supplementary Examinations June 2017

HEAT TRANSFER

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

Use of heat transfer data book and steam tables is permitted in the examination hall

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1 (a) Heat is generated within a sphere at 2.07 x 10^8 W/m^3. The sphere is 8 cm in diameter. The surface temperature is 370 K. (i) Calculate the temperature at the center of the sphere. (ii) Calculate the temperature at a radial distance of 2 cm.

(b) Define and distinguish between: (i) Steady state. (ii) Unsteady state. (iii) Transient state of heat transfer.

2 (a) The heat flow rate through a 3 cm thick wood board for a temperature difference of 30^0C between the two surfaces is 120 W/m^2. Calculate the thermal conductivity of wood board.

(b) Derive the temperature distribution in the 1-D steady state hallow sphere.

3 (a) What is lumped mass system? When is it applicable? Explain the method to find the heat transfer in a lumped mass body.

(b) A thick bronze plat with the thermal diffusivity 0.86 x 10^{-5} m^2/s has thermal conductivity 26 W/m K is initially at a uniform temperature of 250^0C. Suddenly the surface is exposed to a coolant at 25^0C. Assuming the heat transfer coefficient 150 W/m^2K, determine the temperature 5 cm from the surface 10 min after the exposure.

4 (a) Air at 30^0C is flowing over 2 cm long plate maintained at 70^0C at a velocity of 50 m/s. Determine heat transfer rate from the plate.

(b) What is the difference between Biot number and Nueselt number? Explain them along with the applications.

5 (a) Discuss briefly effect of turbulence on boundary layers.

(b) Water at 10^0C with a free stream velocity of 1.524 m/s flows across a cylinder of 2.54 cm diameter whose surface is kept at 65.6^0C. Compute the average heat transfer coefficient.

6 (a) What is Leidenfrost point? What is its significance?

(b) Saturated air free steam at 75^0C condenses on a 0.5 m x 0.5 m vertical plate maintained at uniform temperature of 45^0C. Calculate: (i) Average heat transfer coefficient over the entire length of the plate. (ii) The total rate of condensation. (iii) The thickness of the condensate at the bottom of the plate.

7 (a) What are the fouling factors? Explain their effect in heat exchanger design.

(b) A parallel flow heat exchanger has to cool 2500 kg/hr of oil from 70^oC to 30^oC. Cooling water enters the exchanger at 10^oC and leaves at 20^oC. Specific heat of oil is 2.1 kJ/kgK. Determine the effectiveness of the heat exchanger and heat transfer capacity.

8 (a) What is a gray body? How does its emissivity value will vary for the real surface?

(b) An enclosure measures 1.5 x 1.7 m with a height of 2 m. The walls and ceiling are maintained at 250℃ and the floor at 130℃. The walls and ceiling have an emissivity of 0.82 and the floor 0.7. Determine the net radiation to the floor.

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