Code: R7310306

R07

B.Tech III Year I Semester (R07) Supplementary Examinations December 2015

HEAT TRANSFER

(Mechanical Engineering)

(For 2008 regular admitted batch only)

Time: 3 hours Max Marks: 80

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) What are the various boundary conditions needed in general for the analysis of heat conduction problems. Explain with appropriate illustrations.

(b) A thin walled tube of stainless steel [K = 19 W/mK] with 2 cm inner diameter and 4cm outer diameter is covered with 3 cm layer of asbestos insulation [K = 0.2 W/mK]. If the inside wall temperature of the pipe is maintained at 600℃, calculate heat loss per meter length.

2 (a) Describe various types of fins.

(b) Aluminium rod of 5 cm diameter and 1 m length at 200ºC is suddenly exposed to a convective environment at 70ºC. Calculate the temperature at a radius of 1cm and heat lost per meter length of the rod are minute after the rod is exposed to the environment. Take film heat transfer coefficient as 500 $W/m^2.K$.

3 (a) Define Biot number and Fourier number. Explain the significance of each.

(b) A brick (24 x 10 x 8) is heated to a uniform temperature of 400^0C and allowed to cool in air at a temperature of 25^0C. Calculate the temperature at the center of the brick after 100 min have elapsed. Take h = 10 W/m^2 K, K = 1.0 $W/m^2.K$, α= 3.33 X 10^{-3} m^2/h.

4 (a) Air at 35℃ flows across a cylinder of 50 mm diameter at a velocity of 50 m/sec, the cylinder surface is maintained at 145℃. Calculate the heat loss per unit length of the cylinder.

(b) Distinguish between laminar and turbulent flow in a physical sense.

5 (a) What is the criterion from laminar to turbulent flow in natural convection?

(b) A vertical pipe 5 cm diameter and 1m high is maintained at a temperature of 65^0C in atmospheric air at 15^0C. Calculate the rate of heat loss by free convection from the cylinder to air.

6 (a) State the regimes of the pool boiling.

(b) It is desired to generate 100 kg/h of saturated steam at 100^0C using a heating element of copper of surface area 5 m^2. Calculate the convective heat transfer coefficient, the temperature of the heating surface and the critical heat flux.

7 (a) What do you understand by mixed flow and un mixed flow?

(b) A test is conducted to determine the overall heat transfer coefficient in an automatic radiator that is a compact cross flow water to air heat exchanger with both fluids unmixed. The radiator has 40 tubes of internal diameter om 5 cm and length 65 cm in a closed spaced plate-finned matrix. Hot water enters the tubes at 90^0C at a rate of 0.6 kg/s and leaves at 65^0C. Air flows across the radiator through the inter fin spaces and is heated from 20^0C to 40^0C. Determine the overall heat transfer coefficient of this radiator based o the inner surface area of the tubes.

8 (a) Define emissivity of a surface. Explain spectral, directional, hemispherical and total emissivity.

(b) An enclosure measures 1.5 m X 1.7 m with a height of 2 m. The walls and ceiling are maintained at 250^0C and the floor at 130^0C. The walls and ceiling have emissivity of 0.82 and floor 0.7. Determine the net radiation to the floor.