Code No: NR-320305

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III-B.Tech II-Semester Supplementary Examinations April/May-2005

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 furnace wall is made of 2 successive layers of insulating materials one of foamed fire clay (k = 0.279 + 0.000273T) w/m ^{0}c and red brick (k= 0.7 w/m^{o}c). The wall temperature inside the furnace wall is 1373 K and outside wall temperature is 323 K. If the thickness of insulation being 12.5cm of foam clay and 50cm of red brick, calculate the amount of heat lost from 100m^2 of furnace wall. Also calculate the temperature at interface layer.

2. The outside and inside surface temperatures of a 20cm outer diameter & 18cm inner diameter pipe (k=40w/mk) are 400^{o}C & 460^{o}C respectively. Calculate the reduction in heat loss if a 5cm layer of insulation (k=0.06 w/mk) is put on the pipe. Assume that the inner and outer surface temperature of insulation is 390^{o}C & 140^{o}C. What is the inside surface temperature of this pipe in this case?

3. a) How is the coefficient of cubical expansion for liquids evaluated? Derive the expression for the same.

   b) Air at 25°C flows normally to 0.03m outer diameter water pipe with a velocity of 1m/s. If the surface temperature of the pipe is 75°C, estimate the heat transfer per unit length. Use the correlation Nu = 0.683 $(Pr)^{0.333}(Re)^{0.466}$. The relevant properties of air are: Thermal conductivity is 0.0282 W/(m.K). Kinematic viscosity is 1.795×10^{-5} m^2/s. Pr is 0.698.

4. a) How is Stanton number computed? Explain its physical significance.

   b) Explain in detail liquid metal heat transfer.

   c) A plate 0.6 m high and 0.3 m wide, having a surface temperature of 35°C, is in contact with air at 20°C. If the observed convective heat transfer rate is 45W for each side, compute the average convection coefficient.

5. a) Explain the characteristics of flow boiling.

   b) Write short notes on Turbulent film condensation and Condensation number.

6. Discuss the following:
   a) Square of the distance effect
   b) Radiation to semitransparent materials.

7. In an industry, 0.6 kg/sec of oil(Specific heat = 2.5 kJ/kgK) is to be cooled in a counter flow heat exchanger from 110^{o}C to 35^{o}C by the use of water entering at 20^{o}C. The overall heat transfer coefficient is 1500 W/m^{2}K. If the exit temperature of water is not to exceed 80^{o}C, using NTU method, Calculate (i) the water flow rate (ii) the heat transfer surface area required (iii) the effectiveness of the heat exchanger.

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8. a) With a neat diagram, explain the working of a Floating head Heat Exchanger.
   b) With a neat diagram, explain the working of a forced circulation evaporator.

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