Code No: NR320305 **NR**

III B.Tech II Semester Supplementary Examinations,
November/December 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) Write the rate equation for the three modes of heat transfer. Define the symbols used and give the units for each.
   (b) Clearly bring out the difference between one, two, and three- dimensional temperature fields and heat flows. [8+8]

2. Heat at the rate of 0.5 MW/m^3 is generated in a 50 mm thick wall having thermal conductivity 18 W/mK. One side of the wall exposed to environment at 50^0C with a heat transfer coefficient of $450W/m^2K$. Calculate the maximum temperature in the wall if the outer side of the wall is insulated? [16]

3. (a) Describe the physical mechanism of convections. How is the convection heat transfer coefficient related to this mechanism?
   (b) A horizontal pipe 0.3048 m in diameter is maintained at a temperature of 250^0C in a room where the ambient air is at 15^0C. Calculate the free covection heat loss per meter of length. [8+8]

4. What do you understand by the hydrodynamics and thermal boundary layers. Illustrate with reference to flow over a flat heated plate. [16]

5. (a) A heated polished copper plate is immersed in a pool of water boiling at atmospheric pressure. If the surface of the copper plate is maintained at a temperature of 125^oC, find the surface heat flux and the evaporation rate per unit area of the plate.
   (b) A 10mm dia, 1m long copper tube with a scored surface is to be used to boil water adjacent to the external surface at atm pr, Calculate the surface temperature of the tube so that it operates at half the maximum heat flux. Find also the heat dissipation rate and the evaporation rate of water. [8+8]

6. (a) State and prove reciprocity theorem as applied to radiation shape factors.
   (b) Two concentric cylinders having diameters of 10cm and 20cm have a length of 20cm. Calculate the shape factor between the open ends of the cylinders. [4+12]

7. Steam is condensed in a single pass condenser at a pressure of 0.5 bar. The condenser consists of 100 thin walled tubes of 2.5 cm nominal diameter and 2m length. The cooling water enters and leaves at a temperature of 10^oC and 50^oC with a mean velocity of 2 m/Sec. The condensing heat transfer coefficient is $5KW/m^2 - K$. Find

(a) Overall heat transfer coefficient for heat exchanger

(b) Condensation rate of steam

(c) Mean temperature of metal at the center of condenser length . [16]

8. What are the dimensionless quantities, which govern convective mass transfer? What are their equivalents in heat transfer? [16]

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