Code No: OR320353 **OR**

III B.Tech II Semester Supplementary Examinations, April/May 2005
HEAT TRANSFER
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an expression for heat transfer through a cylindrical pipe in standard form.
   (b) A wall of 0.5 m thickness is to be constructed from a material which has thermal conductivity of 1.4 $\frac{W}{mK}$. The wall is to be insulated with a material having thermal conductivity of 0.35$\frac{W}{mK}$, so that the heat loss per square metre will not exceed 1450W. Assuming that the inner and outer surface temperatures are 1200°C and15°C respectively, calculate the thickness of insulation required.

2. (a) Derive an expression for the temperature distribution in a fin of finite length and heat loss by convection from its free end.
   (b) An Aluminium alloy fin 3mm thick and 2 cm long protrudes from a wall. The base is at 400°C and ambient temperature is 35°C.Calculate the heat loss from the fin per unit depth of wall. Also find the efficiency and effectiveness of the fin. Take K=40 $\frac{W}{mK}$ for fin material and $h = 10\frac{W}{m^2K}$.

3. (a) Derive an expression for Nusselt number for free convection heat transfer using Buckingham theorem.
   (b) If the velocity profile in the boundary layer of a flat plate is given by an expression, $\frac{u}{U} = \sin\frac{\pi}{2}\left(\frac{y}{\delta}\right)$, find an expression for boundary layer thickness

4. (a) A thin plate of length 2m and width 1.5m is exposed to a flow of air parallel to its surface along 2m side. The velocity and temperature of flow of air are 3m/sec and20°C respectively. The plate surface temperature is 90°C. Find the heat transferred from both sides of plate.
   (b) Calculate the convective heat loss from a radiator 0.75m wide and 1.2m high maintained at a temperature of 92°C in a room at 27°C. Assume tha radiator to be a vertical plate.

5. (a) Using plancks law of distribution, derive wiens displacement law.
   (b) Two large parallel planes with emissivities 0.4(T=500K) and 0.8(T=700K) exchange heat. Find the net heat radiated by them and percentage reduction in heat transfer when polished Aluminium radiation shield, with emissivity 0.04, is placed between them.

6. (a) A vertical square plate (30cmX30cm) is exposed to steam at atmospheric pressure. The plate temperature is maintained at 98°C. Calculate the heat transfer rate and mass of steam condensed per hour.

(b) Draw the boiling curve and explain the various regimes of boiling.

7. (a) What is fouling? What are its effects on heat exchanger performance?

   (b) The inlet and outlet temperatures of hot and cold fluids in a double pipe heat exchanger are 220^0C, 100^0C, *and* 80^0C *and* 120^0C . Find whether the exchanger is parallel flow or counter flow. Also find, the LMTD and effectiveness of the exchanger and the capacity ratio.

8. Write short notes on the following:

   (a) Non-dimensional numbers in unsteady state heat conduction.

   (b) Radiation shape factor

   (c) Hailer charts.

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