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Roll No.....

MMTP-103

M.E./M.Tech. I Semester

Examination, December 2017

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: i) Answer any five questions.
ii) All questions carry equal marks.
iii) Assume suitable data if missing.

1. a) Derive an equation for heat loss per square m of inside surface area from a pipe insulated with three layers of insulation with thermal conductivities K_1, K_2 and K_3.

   b) Define fin effectiveness. When is the use of fin not justified?

2. A steam boiler furnace is made of layer of fireclay 12.5cm thick and a layer of red brick 50cm thick. If the wall temperature inside the boiler furnace is 1100°C and that on the outside wall is 50°C, determine the amount of loss per sq.m. of furnace wall ($K_{fireclay}$=0.533W/kmK) and ($K_{redbrick}$=0.7W/mK).
   It is desired the thickness of the red brick layer is made half by filling in the gap between two layers by diatomite whose K=0.113+0.00023T W/mK. Calculate the thickness of filling to ensure an identical loss.

3. a) Explain the concept of velocity and thermal boundary layer.

   b) Using dimensional analysis obtain general form of equation for natural convection heat transfer.

4. a) Discuss different methods of determining heat transfer coefficient in faced convection.

   b) Why is heat transfer coefficient in nucleate boiling is 10-20 times greater than in film boiling.

5. Obtain an expression for the local heat transfer coefficient in film wise condensation over a vertical plate. Dry saturated steam at a pressure of 2.45bar condenser on the surface of a vertical plate 300mm wide and 1.2m high and maintained at temp. of 70°C. Calculate the heat transfer coefficient and total mass of steam condensed per hour.

6. A Hemispherical cavity of radius 0.75m is covered with a plate having a hole of 0.25mm.dia. drilled in the centre. The inner surface of the plate is maintained at 550k by a heater embedded in the surface. Assuming the surfaces to be black and the Hemisphere to be insulated calculate:

   a) The temp. of the surface of Hemisphere

   b) Power input to heater

7. a) Discuss the factors on which radiative heat exchang between two bodies depend.

   b) Explain Fick's law of diffusion.

8. Write short notes on any two of the following:

   a) Analog between heat transfer and mass transfer

   b) Turbulent film condensation

   c) Shape factor algebra.

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