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Roll No .....

ME-6003 (CBGS)

B.E. VI Semester

Examination, May 2018

Choice Based Grading System (CBGS)

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Draw neat diagram wherever required.

1. a) Define thermal conductivity. How it can be determined?

   b) A 3mm thick metal plate having thermal conductivity K = –98.6 m/m–deg, is exposed to vapour at 100°C on one side and cooling water at 30°C on the opposite side. The heat coefficients are h_i = 14200 w/m^2–deg on vapour side h_o = 2325 w/m^2-deg on the water side. Determine heat transfer rate, overall heat transfer coefficient and the drop in temperature each side of heat transfer.

2. a) State Fourier's law and Newton's law.

   b) Discuss three modes of heat transfer with examples.

   c) Derive Fourier heat conduction equation. State its form in cylindrical and rectangle co-ordinates.

3. A fin K = 29 W/mk, in the form of a blade is a 60mm long, 500m^2 cross section and 120mm perimeter. The temperature of the root of fin is 480°C and it is exposed to ambient conditions of 200°C. The fin coefficient is 320 W/m^2 K. Determine the temperature at the middle of the blade, the rate of heat flow from the blade. Assume negligible heat loss from the tip of the fin.

4. a) Compare free and forced convection.
   b) State the applications of dimensional analysis.
   c) Write the Buckingham pie theorem.
   d) Air at a pressure 6 kN/m^2 and a temperature of 270°C flows over a flat plate of 3mm wide and 1000mm long at a velocity of 8 m/s. If the plate is to be maintained at a temperature of 75°C. Estimate the rate of heat to be removed continuously from the plate.

5. Deduce LMD equations for parallel flow heat exchangers.

6. a) Explain steady state diffusion through stationary medium.
   b) Explain Fick's law of diffusion. And explain diffusion coefficient.

7. If the inside surface temperature of hemispherical cavity of 0.5m diameter is 400°C and its emissivity is 0.6. Calculate the rate of radiant heat transfer from the cavity with the help of neat diagram.

8. Write short notes on the following:
   a) Nusselt theory for film wise condensation
   b) Distinguish between black and gray surfaces
   c) Shape factor

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