Code: ME5T3

III B.Tech - I Semester – Regular Examinations – December 2016

HEAT TRANSFER
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A
Answer *all* the questions.   All questions carry equal marks
                                              11x 2 = 22 M

1. a) What is thermal conductivity?
   b) Explain about newton's law of convection?
   c) How would you define three distinct modes of heat transfer?
   d) What is significance of Biot & Fourier numbers?
   e) What is meant by overall heat transfer coefficient explain with neat sketch?
   f) Can you define few non dimensional numbers?
   g) What is meant by dimensional analysis?
   h) What is meant by film wise & drop wise condensation?
   i) How do you classify heat Exchangers?
   j) What can you write about radiation shields?
   k) How do you define Lambertz and Stefan Boltzmann Law?

PART – B

Answer any **THREE** questions.   All questions carry equal marks.   3 x 16 = 48 M

2. a) Can you explain in detail about conduction heat transfer.   8 M

   b) How would you apply what you learned to develop the general heat conduction equation in spherical coordinates.   8 M

3. a) How would you develop the expression for the temperature distribution and heat transfer rate through a short fin.   8 M

   b) A *1mm* thick and *3cm* long aluminum fin protrudes from a wall at 65^oC into air at 40^oC ($h=30W/m^2K$ and $k= 200W/mK$). Calculate the heat flow from the fin per meter depth of material.   8 M

4. a) What is meant by Buckingham theorem. Can you explain the various parameters used in natural convection? Using dimensional analysis obtain an expression for nusselt number in term of groshoff & prandtl numbers.   8 M

b) A horizontal cylinder of *5cm* in diameter and *1m* long maintained at a uniform temperature of *140°C* is exposed to atmospheric air at *10°C*. Calculate the free convection heat transfer coefficient and compare the value that is obtainable from simplified expression.

8 M

5. a) How do you develop an expression for *LMTD* for counter flow heat exchangers. 8 M

b) In a counter flow double pipe heat exchanger, water is heated from *25°C* to *65°C* by an oil with a specific heat of *1.45 kJ/kgK* and mass flow rate of *0.9 kg/s*. The oil is cooled from *230°C* to *160°C*. If the overall heat transfer coefficient is *420W/m²K*. Calculate the following: 8 M
  (i) The rate of heat transfer
  (ii) The mass flow rate of water and
  (iii) The surface area of the heat exchanger.

6. a) Explain about concept of shape factor. 8 M

b) Explain in detail about use of electrical analogy for solving radiation network problem. 8 M