H.T.No. | | | | | | | | | | |

Code No: ME1540 **GEC-R14**

IV B. Tech I Semester Regular Examinations, November 2017

HEAT TRANSFER

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. Identify the mode of heat transfer in the following.
   a) Heat transfer from a room heater.
   b) Boiling of water in a boiler.
2. Define Fourier number.
3. a) Define thermal boundary layer.
   b) Define Reynolds number.
4. What are the various regimes in a pool boiling curve?
5. Discuss the advantages of NTU Method over LMTD method.
6. How does radiosity for a surface differ from the emitted energy?

PART-B

4 × 12 = 48M

1. a) A fire clay wall 20 cm thick has its two surfaces maintained at 1000^0C and 200^0C. The thermal conductivity of the fire clay varies with temperature in ^{0}C as $k = 0.813 + 0.000582T$. Calculate the rate of heat flow per m^2 of normal area. (8M)

   b) A hot plate maintained at a temperature of 120^0C dissipates heat at the rate of 7500 W/m^2 to the ambient air at 30^0C. Calculate the heat transfer co-efficient for convection between the plate and the air. (4M)

2. a) Derive the expression for temperature distribution and heat dissipation for a long fin. (6M)

   b) A 40×40 cm copper slab 5mm thick at a uniform temperature of 250^0C suddenly has its surface temperature lowered to 30^0C. Find the time at which the slab temperature becomes 90^0C. Take ρ = 9000 kg/m^3, C =380 J/kgK , k = 370 W/mK and h = 90 W/m^{2}K. (6M)

3. Using dimensional analysis, obtain the general form of equation for natural convective heat transfer as a relation between Nusselt, Prandtl and Grashoff numbers. (12M)

4. a) A metallic element (emissivity =1) of 6 mm diameter is submerged horizontally in a water bath. Determine the power dissipation per unit length of the heater assuming its surface temperature 255°C, in a stable film boiling. (6M)

   b) A steam condenser consists of 100 tubes each of 1.27 mm in diameter are arranged in a square array. If the tubes are exposed to steam at atmospheric pressure. The tube temperature is maintained at 98^0C. What is the rate at which heat is lost by the steam and the mass of steam condensed per unit length of tubes? (6M)

5. a) What is parallel flow, counter flow and cross flow heat exchangers? Which is more effective? (4M)

   b) Water enters a counter flow heat exchanger at 5^0C and flows at the rate of 4600 kg/hr to cool 4000 kg/hr of air that is initially at 40^0C. Assume U value to be 150 W/m^2-K, for a heat exchanger surface area of 25 m^2, calculate the exit temperature of air and water. (8M)

6. a) State Kirchhoff's law. Explain it briefly. (4M)

   b) Two large gray parallel plates, separated by a small distance, have surface temperatures of 400 K and 300 K. If the emissivity's of the surfaces are 0.8. Calculate the net radiation heat exchange rate in W/m^2 between two plates. (8M)

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