PVP 14

Code: ME5T3

III B.Tech - I Semester – Regular/Supplementary Examinations
October 2017

HEAT TRANSFER
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

** Heat and mass transfer data books are allowed*

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22 M

1.

a) Though the diamond is not a metal, it will have higher thermal conductivity. Explain it.
b) List the applications of heat transfer in engineering science.
c) What are the assumptions in Fourier heat conduction law.
d) Derive the governing equation for a plane slab with internal heat generation.
e) Can you explain the critical radius of insulation concept for a plane slab?
f) Define the terms Momentum thickness and Energy thickness.
g) Draw the profile for thermal boundary layer.
h) How would you classify types of condensation process?
i) Air enters a counter flow heat exchanger at 70^0C and leaves at 40^0C. Water enter at 30^0C and leaves at 50^0C, then calculate LMTD of the heat exchanger.

j) What do you understand by blackbody radiation?

k) How can you differentiate radiation mode of heat transfer with other modes?

PART – B

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

2. a) Can you explain in detail about mechanism of heat transfer in different modes of heat transfer. 8 M

b) How would you apply what you learned to develop the general heat conduction equation in cylindrical co-ordinates. 8 M

3. a) Derive the expression for heat transfer rate for a sphere with internal heat generation. 8 M

b) Show that the temperature variation in a plane slab is linear. 8 M

4. Calculate the rate of heat loss from human body which may be considered as a vertical cylinder 28cm diameter and 180 cm high in still air at 15^0C. The skin temperature is 35^0C and emissivity at skin surface is 0.4. Neglecting other effects $Nu=0.13(Gr.Pr)^{0.33}$.
Given kinematic viscosity $=15.53X10^{-6}$ m^2/sec, k=0.0263W/mK. Pr=0.7 16 M

5. a) Explain about parallel flow and counter flow heat exchangers with neat sketches of temperature profiles. 8 M

b) Derive the expression for NTU for parallel flow heat exchanger. 8 M

6. a) Briefly explain what you understand by Kirchhoff law. 8 M

b) A solid cylinder (surface 2) is located at the centre of a hollow sphere (surface 1). The diameter of the sphere is 1m, while the cylinder has a diameter and length of 0.5m each then calculate the radiation configuration factor $F_{11.}$ 8 M