Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCME 4305

Sixth Semester Back Examination – 2015

HEAT TRANSFER

BRANCH : MECH

QUESTION CODE : M 400

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any ***five*** *from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) How radiation is different from convection ?

(b) Differentiate between black body and gray body.

(c) Differentiate between counter flow and parallel heat exchanger.

(d) What do you mean by Fourier number ?

(e) Show the velocity profile in laminar region and turbulent region.

(f) Mention the boundary layer thickness formula for laminar and turbulent region over a flat plate.

(g) White paper is a black body. Justify.

(h) What is laminar sub layer ? What is the velocity profile in this region ?

(i) What is fin ? Write two applications where fins are used.

(j) Explain thermal diffusivity. Give its physical significance.

P.T.O.

2. (a) What do you understand by critical thickness ? Derive the critical thickness value of insulation over a cylindrical conduit. 5

(b) Define the following terms : 5

(i) Prandtl number

(ii) Biot number

(iii) Nusselt number.

3. (a) Explain Effectiveness of a fin. How is different from fin efficiency ? 5

(b) A rectangular plate is 120 cm long in the direction of flow and 200 cm wide. The plate is maintained at 80°C when placed in nitrogen that has a velocity of 2.5 m/s and a temperature of 0°C. Determine : 5

(i) the average heat transfer coefficient

(ii) the total heat transfer from the plate. The properties of Nitrogen at 40°C are $\rho = 1.142$ kg/m^3, Cp = 1.04 kJ/kgK, $v = 15.63 \times 10^{-6}$ m^2/s and k = 0.0262 W/mK.

4. A 1.6 m high and 3 m wide double-pane window consists of two 8 mm thick layers of glass(k = 78 W/m K) separated by a 15 mm wide stagnant air space (k = 0.026 W/mK). Determine the rate of heat transfer through this window and temperature of inside surface, when the room is maintained at 25°C and the out side air is at 0°C. Take the convection coefficient on the inside and out side surfaces of the window as 10 and 40 W/m^{2}K respectively. Find the overall heat transfer coefficient. 10

5. The overall temperature rise of the cold fluid in a cross flow heat exchanger is 20°C and overall temperature drop of the hot fluid is 30°C. The effectiveness of heat exchanger is 0.5. The heat exchanger area is 1 m^2 and overall heat transfer coefficient is 60 W/m^2 K. Find out the rate of heat transfer. Assume both fluids are mixed. 10

6. (a) Explain and differentiate between Film wise and drop wise condensation. 5

(b) Explain and differentiate between flow boiling and pool boiling. 5

7. (a) Explain about Kirchhoff's law, Planck's law, Wein's law and Stefan Boltzman law. 5

(b) An enclosure measures 1.5 m x 1.7 m with a height of 2 m. The walls and ceiling are maintained at 250°C and the floor at 130°C. The walls and ceiling have an emissivity of 0.82 and the floor 0.7. Determine the net radiation to the floor. 5

8. Write short notes on any **two** of the following : 5×2

(a) Forced convection and natural convection

(b) Lumped heat analysis

(c) LMTD and NTU method.