G 470 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Sixth Semester

Branch : Mechanical Engineering / Automobile Engineering

HEAT AND MASS TRANSFER (M, U)

(Old Scheme—Prior to 2010 Admissions)

(Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Write the heat conduction equation through a composite Cylindrical Wall.
2. Define Furier's law of heat conduction.
3. Discuss the significance of Reynold's analogy.
4. Briefly explain Newton's law of connection.
5. List the applications of a cross flow heat exchanger.
6. Briefly explain the importance of fins in automobiles.
7. Define reflectivity and absorptivity.
8. What is a black body ?
9. State Fick's law of diffusion in gases.
10. List the dimensionless numbers governing drop-wise condensation.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Sheets of brass and steel, each 1 cm. thick, are placed in contact. The outer surface of brass is kept at 100°C and the outer surface of steel is kept at 0°C. What is the temperature of the common interface ? The thermal conductivities of brass and steel are in the ratio of 2 : 1.

(12 marks)

Or

(b) In a pipe carrying steam, the outside surface (15 cm. OD) is at 300°C. The pipe is to be covered with insulation (C_k = 0.07 W/mk) such that the outside surface temperature does not exceed 60°C. The atmosphere is at 25°C and the heat transfer coefficient is 11.6 W/m^{2}k. Find the thickness of insulation required and the rate of heat loss per *m* length of pipe.

(12 marks)

12. (a) A hollow sphere (k = 35 W/mk), the inner and outer diameters of which are 28 cm. and 32 cm. respectively, is heated by means of a 20 ohm coil placed inside the sphere. Calculate the current required to keep the two surfaces at a constant temperature difference of 50°C and calculate the rate of heat supply.

(12 marks)

Or

(b) Define all the dimensionless numbers influencing heat transfer. Explain the application of Buckingham's Pi theorem in natural convection.

(12 marks)

13. (a) Discuss the procedure and considerations in design of shell and tube heat exchangers.

(12 marks)

Or

(b) Explain the NTU method of evaluation of heat exchangers. Compare this method with the LMTD method.

(12 marks)

14. (a) A long steel rod, 2 cm. in diameter, is to be heated from 427°C to 538°C. It is placed concentrically in a long cylindrical furnace which has an inside diameter of 16 cm. The inner surface of the furnace is at a temperature of 1093°C, and has an emissivity of 0.6. Find the time required for the heating operation. Take for steel, s = 7845 kg/m^3. and c = 0.67 kJ/kgK.

(12 marks)

Or

(b) Explain :—

(i) Planck's distribution law. (6 marks)

(ii) Total emissive power. (6 marks)

15. (a) Discuss the empirical equations for heat transfer with change of phase. (12 marks)

Or

(b) Discuss the analogy between heat transfer and mass transfer. Give suitable example.

(12 marks)

[5 × 12 = 60 marks]