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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, June 2017
(2013 Scheme)
13.604 : HEAT AND MASS TRANSFER (MSU)
(HMT Data Book and Steam Tables may be Permitted)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions, **each** carries **2** marks.

1. What is the functional meaning of the term infinite fin ?
2. Define time constant for a temperature sensor.
3. Give some examples of heat transfer in engineering.
4. What is physical meaning of Nusselt number ?
5. What is meant by critical Reynolds number ?
6. What is the difference between effectiveness and efficiency ?
7. Define overall heat transfer coefficient.
8. Define mass transfer fluxes.
9. Define shape factor.
10. What is radiation shield ?

PART – B

Answer **any one** question from **each** Module. **Each** carries **20** marks.

Module – I

11. A copper plate 2 mm thick is heated upto 400°C and quenched into water at 30°C. Find the time required for the plate to reach the temperature of 50°C. Heat transfer co-efficient is 100 W/m^2K. Density of copper is 8800 kg/m^3. Specific heat of copper = 0.36 kJ/kg K. Dimension = 30 × 30 cm.

OR

12. A carbon steel (K = 35 W/mk) 90 mm long rod with cross sectional area $5 \times 10^{-3} m^2$ and perimeter 0.69 m is attached to a plane wall which is maintained at a temperature of 400°C. The surrounding environment is at 50°C and heat transfer co-efficient is 90 W/m^2K. Calculate the heat dissipated by the rod.

P.T.O.

Module – II

13. Air at 400 K and 1 atm pressure flows at a speed of 1.5 m/s over a flat plate of 2 m long. The plate is maintained at a uniform temperature of 300 K. If the plate has a width of 0.5 m, estimate the heat transfer coefficient and the rate of heat transfer from the ait stream to the plate. Also estimate the drag force acting on the plate.

OR

14. Engine oil flows through a 50 mm diameter tube at an average temperature of 147° C. The flow velocity is 80 cm/s. Calculate the average heat transfer coefficient of the tube wall maintained at a temperature of 200°C and it is 2 m long.

Module – III

15. In a counter flow double pipe heat exchanger, oil cooled from 85°C to 55°C by water entering at 25°C. The mass flow rate of oil is 9800 kg/h and specific heat of oil is 2000 J/kgK. The mass flow rate of water is 8000 kg/h and specific heat of water is 4180 J/kgK. Determine the heat exchanger area and heat transfer rate for an overall heat transfer co-efficient of 280 W/m^2K.

OR

16. A condenser is to be designed to condense 600 kg/h of dry saturated steam at a pressure of 0.12 bar. A square array of 400 tubes, each of 8 mm diameter is to be used. The tube surface is maintained at 30°C. Calculate the heat transfer coefficient and the length of each tube.

Module – IV

17. A thin aluminum sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures T_1 = 800 K and T_2 = 500 K and have emissivity £" 1 = 0.2 and £" 2 = 0.7 respectively. Determine the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without shield.

OR

18. Air at 10°C with a velocity of 3 m/s flows over a flat plate. The plate is 0.3 m long. Calculate the mass transfer coefficient.