B.Tech III Year I Semester (R13) Supplementary Examinations June 2016

HEAT TRANSFER

(Mechanical Engineering)

Use of heat transfer data book and steam tables is permitted in the examination hall

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What are the different modes of heat transfer?

(b) Define thermal conductivity.

(c) Define biot number.

(d) Define fin efficiency.

(e) What is the significance of Reynolds number?

(f) Write down the energy equation for thermal boundary layer in Cartesian coordinates in 2D over a flat plate.

(g) Explain the condensation process.

(h) Define effectiveness of a heat exchanger.

(i) State Stefan-Boltzmann law.

(j) What is shape factor?

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 Derive the heat conduction equation in rectangular coordinate system.

OR

3 An interior wall of a furnace may be approximated by a 10.2 cm layer of common brick with thermal conductivity of 0.7 W/mK followed by 3.79 cm layer of gypsum, thermal conductivity = 0.48 W/mK. What is the thickness of loosely packed rock wool, thermal conductivity = 0.065 W/mK should be added to reduce the heat transfer by 80%.

UNIT - II

4 A short end insulated fin is 1 cm in diameter and 3 cm long. Thermal conductivity of the material is 43 W/mK and h = 120 W/m^{2}K. The base temperature is 200℃ and surrounding temperature is 25℃. Determine heat dissipated, if the length is increased by 50% to 4.5 cm. Determine the percentage increase in heat dissipation.

OR

5 What is the significance of Heisler and Grober charts?

UNIT - III

6 Engine oil at 20℃ flows with a velocity of 1 m/s across a 2.5 cm diameter tube which is maintained at 100℃. Determine the average heat transfer coefficient and rate of heat transfer per m length of the tube.

OR

7 Explain the boundary layer concept in detail.

UNIT - IV

8 What are the three boiling regimes and show the regimes on a boiling curve?

OR

9 An oil flow of 20.15 kg/s at a temperature of 121℃ is to be cooled in a counter flow heat exchanger using 5.04 kg/s water initially at 10℃. The exchanger contains 200 tubes of 4.87 m long and 1.97 cm OD. The overall heat transfer coefficient is 340 W/m^{2}K. Specific heat of oil is 2.094 Kj/kgK. Calculate the exit temperature of oil.

UNIT - V

10 Two concentric spheres of diameters d_1 = 0.8 m and d_2 = 1.2 m have surface temperatures T_1 = 450 K and T_2 = 300 K respectively. If the surface emissivities are 0.5 and 0.05 respectively. Determine the net radiation heat exchange between the two spheres.

OR

11 Write short notes on: (a) Emissivity (b) Radiation shape factor.

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