

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)

- 1 Answer the following: (10 X 02 = 20 Marks)
- What are the different modes of heat transfer?
 - Define thermal conductivity.
 - Define biot number.
 - Define fin efficiency.
 - What is the significance of Reynolds number?
 - Write down the energy equation for thermal boundary layer in Cartesian coordinates in 2D over a flat plate.
 - Explain the condensation process.
 - Define effectiveness of a heat exchanger.
 - State Stefan-Boltzmann law.
 - 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 $h = 120 \text{ W/m}^2\text{K}$. The base temperature is 200°C and surrounding temperature is 25°C. 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°C flows with a velocity of 1 m/s across a 2.5 cm diameter tube which is maintained at 100°C. 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°C is to be cooled in a counter flow heat exchanger using 5.04 kg/s water initially at 10°C. The exchanger contains 200 tubes of 4.87 m long and 1.97 cm OD. The overall heat transfer coefficient is 340 W/m²K. Specific heat of oil is 2.094 KJ/kgK. Calculate the exit temperature of oil.

UNIT - V

- 10 Two concentric spheres of diameters $d_1 = 0.8 \text{ m}$ and $d_2 = 1.2 \text{ m}$ have surface temperatures $T_1 = 450 \text{ K}$ and $T_2 = 300 \text{ K}$ 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 factor.
