Code: 13A03506

## 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:  $(10 \times 02 = 20 \text{ Marks})$ 

- (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

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

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<sup>2</sup>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.

### ΩR

5 What is the significance of Heisler and Grober charts?

# (UNIT - III)

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

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

Two concentric spheres of diameters  $d_1 = 0.8$  m and  $d_2 = 1.2$  m have surface temperatures  $T_1 = 450$  K and  $T_7 = 300$  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.