B.TECH SEM – V (2007 COURSE) (MECHANICAL ENGG.) :
WINTER - 2017
SUBJECT: HEAT TRANSFER

Day: **Tuesday**
Date: **16/01/2018**

Time: **02.30 PM TO 05.30 PM**
Max Marks: 80

W-2017-2476

N.B:

1) **Q.No.1** and **Q.NO.5** are **COMPULSORY**. Out of remaining question attempt **ANY TWO** questions from each section.
2) Answers to both the sections should be written in the **SEPARATE** answer books.
3) Neat diagrams must be drawn **WHEREVER** necessary.
4) Figures to the **RIGHT** indicate full marks.

SECTION-I

Q.1 **a)** Explain the terms **(05)**

1) Fin efficiency

2) Fin effeteness

b) Explain with neat sketch economic thickness of insulation. **(04)**

c) Explain the variation of thermal conductivity with respect to temperature in **(05)**

1) solids

2) Gases

3) Liquids

Q.2 **a)** Define the general differential equation to heat conduction in Cartesian coordinate system. **(06)**

b) Determine the heat loss from an insulated steel pipe, carrying a hot liquid to the surrounding per meter length of the pipe. Given the following particulars **(07)**

I D of pipe = 15 cm

Wall Thickness = 2cm

Thickness of Insulation =3cm

Temperature of Surrounding = 100^0 c

Temperature of surrounding = 30^0 c

K for steel =50Wlmk

K for insulation = 0.3 W/mK

Inside Heat Transfer coefficient = 700 W/m^2K

Out side.. Heat transfer coefficient = 10 W/m^2K

Q.3 **a)** A aluminum rod 4cm in diameter & 10 cm ling protrudes form a wall which is maintained at 200 ° c. The rod is exposed to an environment at 25^0 C. The convective heat transfer coefficient is 20 W/m^{2K}. Calculate the heat loss by rod. Assume rod end is insulated. **(07)**

Take k for aluminum =150 W/mK.

Also Find the fin efficiency

b) Explain Lumped heat capacity analysis **(06)**

P.T.O.

Q.4 **a)** Derive the heat conduction equation through solid sphere with internal heat generation. **(07)**

b) Explain critical radius of insulation with neat sketch. **(06)**

SECTION - II

Q.5 Explain followings with neat sketch. **(14)**

a) Compact heat Exchangers

b) Radiation shields

c) Thermo hydraulic boundary layer

Q.6 **a)** Define the expression for LMTD for counter flow heat exchanger. **(07)**

b) Explain with heat sketches the different types of cross- flow heat exchangers & the correction factors. **(06)**

Q.7 **a)** Explain **(06)**

1) Band emission

2) Black Body

b) What is Irradiation & Radiosity **(07)**

Q.8 **a)** Give the significance of following **(06)**

1) Nusselt Number

2) Grashof Number

3) Reynolds Number

b) Air at 30^{o} C flows normal to 20mm outer diameter water pipe with a velocity of 1m/s.Estimate the heat transfer per unit length of the surface temperature of the pipe is 70^{o} C **(07)**

Use the correlation, $Nu=0.68\ (Re)^{0.8}\ (pr)^{0.33}$

The relevant properties of air at 50^{o} C are: $\nu = 1.7x10^{-5} m^2/s$. k=0.028W/ms. Pr=0.68.