

B.TECH SEM - IV (2007 COURSE) (CHEMICAL ENGG.) :
WINTER - 2017

SUBJECT: HEAT TRANSFER-I

Day : Thursday
Date : 23/11/2017

W-2017-2398

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

N.B.

- 1) **Q. No 1 and Q. No.5 are COMPULSORY.**
 - 2) Out of remaining attempt any **TWO** questions from each section.
 - 3) Figures in to the right indicate **FULL** marks.
 - 4) Answer to both the section should be written in **SEAPRATE** answer book.
 - 5) Assume suitable data if necessary.
-

SECTION-I

- Q.1** a) Define conduction. Write Fourier's law and heat conduction with mathematical statement. (04)
- b) Differentiate between natural convection and forced convection. (05)
- c) Explain in detail importance of dimensional analysis in experimental design and data reduction. (05)
- Q.2** a) Give the physical significance of : (04)
- i) Reynolds's number
 - ii) Grashoff's number
 - iii) Nusselt number
 - iv) Prandtl number
- b) Write a note on applications of dimensional analysis for natural convection and derive an expression for it, using Buckingham's Π theorem. (09)
- Q.3** a) A furnace is constructed with 229 mm thick of fire brick, 115 mm of insulation brick and again 229 mm of building brick. The inside temperature is 1223 K and temperature at the outermost wall is 323 K. The thermal conduction of fire brick, insulating brick and building brick are 6.05, 0.581 and 2.33 W/mK. Find the heat lost per unit area and temperature at the interface. (08)
- b) Write short note on optimum thickness of insulation. (05)
- Q.4** a) Air at 300 K and 101.325 kPa flows over a flat plate at a velocity of 2 m/s. calculate the boundary layer thickness at a distance of 20 cm and 40 cm from the leading ledge of the plate. Also calculate the mass flow that enters the boundary layers between $x = 20$ cm and $x = 40$ cm. (07)
- b) Write a short note on analogy between heat and momentum transfer. (06)

SECTION-II

- Q.5** a) Define the following terms with formula (04)
- i) emissive power
 - ii) emissivity
 - iii) absorptivity
 - iv) transmittivity
- b) Explain in detail types and classification of different furnaces. (05)
- c) Write a short note on heat transfer in agitated vessel. (05)
- Q.6** a) Calculate the heat loss by radiation from an unlagged horizontal steam pipe, 50 mm outer diameter at 377 K to air at 283 K. Emissivity, $e = 0.90$. (06)

(P.T.O.)

- b)** Explain following laws related to radiation with statement and formula (07)
- i) Kirchoff's law
 - ii) Stefan-Boltzmann law
- Q.7 a)** Explain following methods in detail (13)
- i) Lobo and Evans method
 - ii) Wohlenberg simplified method
 - iii) Orrock-Hudson method
- Q.8** Explain in detail
- a)** Heat transfer in Packed bed (04)
 - b)** Heat transfer in fluidised bed (04)
 - c)** Forced cross flow heat exchanger (05)

* * *