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CH401

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : **151401**

Roll No.

B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15

HEAT TRANSFER

Time : **3** Hours] [Total Marks : **100**

Note : Attempt all questions. In case of numerical problems assume data wherever not provided.

1 Attempt All parts of the following : 2×10=20

(a) What is the difference between heat and enthalpy ?

(b) How the turbulent flow plays a role in heat transfer ?

(c) What is critical insulation thickness and how it differs from optimum insulation ?

(d) Write the physical significance of Prandtl number.

(e) What are the limitations of dimensional analysis.

(f) Define fouling ? Give a reasonable numerical value.

(g) Explain boiling point rise.

(h) How thermal boundary layer depends upon thermal conductivity ?

(i) Define steam economy of evaporator.

(j) How is unsteady state one-dimensional heat conduction described ?

2 Attempt any three parts of the following : 10×3=30

(a) (i) Why is temperature considered on absolute scale ?

(ii) The radiation heat flux from a heater at 950°C in furnace at 250°C is 10kW/m^2. Find the flux when the heater temperature is increased to 1120°C, at the same furnace temperature.

(b) (i) Explain view factor in radiation.

(ii) A pipeline of diameter 0.5 m and emissivity 0.8 carries hot oil at 650 K. It is located in a room at 25°C, which a convective heat loss rate per 'm' length of pipeline by both mechanisms.

(c) A rectangular fin of metal with thermal conductivity 250 W/m K is of dimensions, length 40cm, width 20cm, thickness 1.5mm. It has a base temperature of 400°C and is exposed to air at 28°C, with a heat transfer coefficient of 20 W/m^2K. Calculate the temperature at the tip of the fin.

(d) An electric wire of 2mm diameter and 15m length dissipates 150 W of heat to air at 26°C. Find the critical thickness of mica insulation having K=0.55 W/m K and outside surface heat transfer coefficient as 20 W/m^2K. What will be the consequences if we don't use critical insulation thickness ?

(e) Explain the working of the following with neat sketch

(i) 1-2 shell and tube heat exchanger.

(ii) Calandria type evaporator.

3 Attempt all parts of following : 10×5=50

(a) How to determine heat-transfer coefficient outside the tubes in shell and tube beat exchanger ? Give the equation and calculation procedure.

OR

In a co-current heat exchanger an oil steam is cooled from 500 K to 400 K by water at an inlet temperature of 250 K and outlet temperature of 380 K. the exchanger has tubes of 1m length each. Calculate the tube length if now we want to cool the oil to 390 K by keeping all the other parameters same.

(b) Why the heat transfer due to natural convection takes place ? Which dimensionless numbers are used to correlate the natural convection data ? Give the general form equation used to correlate the experimental data.

OR

Explain hydrodynamic and thermal boundary layer. How does it depend upon thermal conductivity ?

(c) Explain the phenomenon of Nucleate boiling and film boiling. Discuss the effect of ΔT on boiling heat transfer coefficient during the entire boiling operation.

(d) Why do evaporators generally operate under vacuum ? Discuss various methods of feeding in multiple effect evaporators with the help of neat sketches. Discuss their relative merits and demerits.

OR

Differentiate between forced-circulators and agitated film evaporators with the help of neat sketches.

(e) Prove Wien's displacement law from Planck's law equation.

OR

Prove Stefan-Boltzmann law from Planck's law.