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Total No. of Questions : 09

B.Tech.(Petroleum Refinary Engineering) (2013 Onwards) (Sem.–3)

HEAT TRANSFER

Subject Code : BTPC-303

M.Code : 72192

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a. Write down Fourier, Laplace & Poisson equations of heat transfer.

b. What is critical Reynolds number?

c. "*Condensing equipments are always designed for film-wise condensation*" Why?

d. Define thermal diffusivity. What is its physical significance?

e. Define effectiveness and NTU of a heat exchanger.

f. Indicate the various methods of improving the overall efficiency of evaporators.

g. Discuss the advantages of a multiple effect evaporator.

h. Define Kirchhoff's law.

i. Explain the terms "Black body" and "Grey body" with reference to radiant heat transfer.

j. Define view factor and discuss its importance.

SFCTION-B

2. Discuss briefly the difference between film-wise and drop-wise condensation. What are the methods employed to promote drop-wise condensation?

3. Define emissive power and intensity of radiation. Obtain relation between the two.

4. Define LMTD and explain the reason for which this concept is introduced in heat exchanger design. Explain why correction factors are being used when applying this technique for the design of multi-pass heat exchangers.

5. Discuss briefly the phenomenon of nucleate and film boiling. Explain with a neat diagram the various zones of boiling.

6. State Dittus-Boelter equation and Colburn equation for heat transfer and discuss their application.

SECTION-C

7. Water flows through a cast steel pipe (k50 W/m-k) with an outer diameter of 104mm and 2mm wall thickness.

   a. Calculate the heat loss by Convection and conduction per metre length of an insulated pipe when the water temperature is 15 degree Celsius the outer air temperature is –10 degree Celsius the water side heat transfer Coefficient is 30 kilo Watt per metre square per Kelvin and the outside heat transfer Coefficient is 20 Watt per metre square per Kelvin.

   b. Calculate the corresponding heat loss when the pipe is lagged with insulation having an outer diameter of 300 mm and thermal conductivity of k 0.05 Watt per metre per Kelvin.

8. A heat exchanger tube of D – 20mm diameter conveys 0.0983kg/s of water (Pr – 4.3. k – 0.632 W/m K, ρ - 1000kg/m^3. μ – 0.651 × 10^{-1} kg/ms) on the inside which is used to cool a stream of air on the outside where the external heat transfer coefficient has a value of h = 100 W/m^2 K Ignoring the thermal resistance of the tube walls, evaluate the overall heat transfer coefficient, U assuming that the internal heat transfer coefficient is given by the Dittus-Boelter relation for fully) developed turbulent pipe flow.

9. Two large parallel planes are at 1000 k and 600 k. Determine the heat exchanger per unit area.

   a. if surfaces are black.

   b. if the hot one has an emissivity of 0.8 and the cooler one 0.5.

   c. if a large plate is inserted between these two, the plate having an emissivity of 0.2.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.