B.TECH SEM - V (2007 COURSE) (CHEMICAL ENGG.) :
SUMMER - 2018
SUBJECT: HEAT TRANSFER-II

Day : **Wednesday** | **S-2018-2650** | Time : **10.00 AM TO 01.00 PM**
Date : **23/05/2018** | Max. Marks: 80

N. B. :

1) **Q.No.1** and **Q. No.5** are **COMPULSORY.** Attempt **ANY TWO** questions from Section-I and **ANY TWO** from Section-II
2) Figures to the right indicate **FULL** marks.
3) Both the sections should be written in the **SEPARATE** answer books.
4) Use of non programmable **CALCULATOR** is allowed.
5) Assume suitable data, if necessary.

SECTION-I

Q.1 **a)** Explain the procedure to find the number of tubes in shell and tube heat exchanger. **(05)**

b) Differentiate film wise and drop wise condensation. **(04)**

c) Explain with neat diagram pool boiling curve. **(05)**

Q.2 **a)** Saturated steam at 130^0C is flowing through steel (k = 45 w/m^{0}C) pipe of 0.021 m inside diameter and 0.027m outside diameter. The pipe is covered outside with 0.038 thick insulation (k = 0.064 w/m^{0}C) .The ambient air outside the insulation is at 27^0C. Calculate, **(08)**

i) The rate of heat loss per meter length of tube.
ii) Overall heat transfer coefficient based on inside surface area of steel pipe. hi = 5678 w/m^2 ^{0}C, ho = 11 w/m^2 ^{0}C.

b) Explain stepwise procedure to find pressure drop (Δp) in case of shell and tube heat exchanger. **(05)**

Q.3 **a)** It is desired to boil water at atmospheric pressure on a copper surface which is electrically heated. Estimate the heat flux from the surface to the water, if the surface is maintained at 110^0C. **(09)**

$N_{Pr} = 1.75$, $\mu_l = 277.5 \times 10^{-6}\ kg/ms$, $C_{pl} = 4211\ J/kg^0C$,

$\lambda = 2257\ kJ/kg$, $\sigma = 58.9 \times 10^{-3}\ N/m$,

$\rho_l = 958.4\ kg/m^3$ *and* $K_{sf} = 0.013$

b) Write note on heat flux in nucleate boiling. **(04)**

Q.4 **a)** Ammonia vapors at 34^0C are condensed on a horizontal tube. Outside diameter of tube is 30mm and length of tube is 1.6m. Surface temperature of the tube is maintained at 22^0C. Calculate the heat transfer coefficient. Properties of ammonia at average temperature are: **(09)**

$\mu = 0.21 \times 10^{-3}\ N\,s/m^2$,

$\lambda = 1125\ kJ/kg$, $\rho_l = 600\ kg/m^3$

$\rho_v = 0.6894\ kg/m^3$ *and* $k = 0.51$ w/ m^0 C

b) Explain drop wise condensation with neat diagram. **(04)**

P.T.O.

SECTION-II

Q.5 **a)** Define capacity and economy of an evaporator. With the help of a neat diagram explain falling film evaporator. **(06)**

b) Explain the following terms: **(04)**
i) Humid heat ii) Relative humidity

c) Explain in detail Rotary drum dryer with a neat diagram. **(04)**

Q.6 **a)** When and why do we use back ward feed evaporator? **(03)**

b) What is the difference between natural and forced evaporator. **(04)**

c) Explain with neat diagram short tube horizontal evaporator. **(06)**

Q.7 **a)** Discuss the mechanism of moisture movement in solids. **(05)**

b) Under constant drying conditions, a wet solid is dried from 30percent to 4 percent. The time taken is 4 hours. All are on dry basis. The equilibrium moisture content is 2 percent. Critical moisture content is 10 percent. How long it takes to dry to 7 percent? Assume the falling rate is linear, so that the rate of drying is proportional to free moisture content. **(08)**

Q.8 **a)** Give classification of cooling tower. Explain mechanical draft cooling tower. **(07)**

b) Air at a temperature of 20^0C and a pressure of 750 mm Hg has a relative humidity of 80 percent. Calculate. **(06)**
i) The molal humidity of air
ii) The molal humidity of air if its temperature is reduced to 10^0C and its pressure is increased to 35psig, condensing out some of the water.
Data given:
Vapour pressure of water at 20^0C = 17.5 mm Hg,
Vapour pressure of water at 10^0C = 9.2 mm Hg.

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