

**B.TECH SEM - V (2007 COURSE) (CHEMICAL ENGG.) : WINTER  
- 2017  
SUBJECT: HEAT TRANSFER-II**

Day : Tuesday  
Date : 16/01/2018

**W-2017-2445**

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)** Classify heat exchangers on the basis and flow arrangement. Explain in short. **(05)**
- b)** Differentiate between film wise and drop wise condensation. **(05)**
- c)** Explain in detail **(04)**
- i) Pool boiling
  - ii) Flow boiling
  - iii) Saturated pool boiling

- Q.2** Calculate the total length of double pipe heat exchanger required to cool 5500 kg/hr of ethylene glycol from 358 K (85°C) TO 341 K (68°C) using toluene as a cooling media which flows in counter current fashion. Toluene enters at 303 K and leaves at 335 K. **(13)**

Data:

Outside diameter of outside pipe = 70 mm

Outside diameter of inside pipe = 43 mm

Wall thickness of both pipes = 3 mm

Mean properties of two fluids one given below:

Property	Ethylene glycol	Toluene
Density	1080 kg/m <sup>3</sup>	840 kg/m <sup>3</sup>
Specific heat	2.680 kJ/(kg K)	1.80 kJ/(kg.K)
Thermal conductivity	0.248 W/(m K)	0.146 W/(m K)
Viscosity	3.4 *10 <sup>-3</sup> Pas	4.4 *10 <sup>-4</sup> Pas

Thermal conductivity of metal pipe is 46.52 W/(m K) and ethylene glycol is flowing through the inner pipe.

- Q.3 a)** Derive the equation for average heat transfer coefficient for condensation on a vertical plate using Nusselt's theory. Write all assumptions. **(09)**
- b)** Write a short note on effect of superheated vapors and of non-condensable gases on condensation. **(04)**
- Q.4 a)** Explain correlations in pool boiling heat transfer for **(06)**
- i) Nucleate saturated pool boiling
  - ii) Peak heat flux in nucleate pool boiling.
  - iii) Stable pool boiling.
- b)** Explain in detail pool boiling of saturated liquid. **(07)**

**(P. T. O.)**

**SECTION-II**

- Q.5** a) Draw neat labeled diagram of **(04)**  
i) Forwarded feed arrangement for multiple effect evaporator system  
ii) Backward feed arrangement for multiple effect evaporator system
- b) Write note on mechanism of moisture movement in solids. **(05)**
- c) Explain following terms. **(05)**  
i) Adiabatic saturation temperature  
ii) Wet bulb temperature  
iii) Humid heat
- Q.6** a) Explain vapour recompressing technique. **(06)**  
b) Explain horizontal tube evaporator with neat diagram. **(07)**
- Q.7** a) Explain design principles of dryer. **(06)**  
b) Draw rate of drying curve. Explain it in detail. **(07)**
- Q.8** Write short note on
- a) Lewis relation **(04)**  
b) Spray ponds **(04)**  
c) Vapour liquid equilibrium. **(05)**

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