BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - IV CHEMICAL :SUMMER- 2022
SUBJECT : DESIGN OF HEAT TRANSFER EQUIPMENT

Day : Monday
Date : 20-06-2022

S-24442-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labelled diagram **WHEREVER** necessary.
4) Assume suitable data if necessary.

Q.1 Enlist the steps involved in design of double pipe heat exchanger (DHPE). What are the limitations of DPHE? **[10]**

OR

Q.1 Derive an expression for LMTD for counter-current flow arrangement. **[10]**

Q.2 What are the advantages of shell and tube heat exchanger (STHE) over DPHE? **[10]**

OR

Q.2 Derive an expression for equivalent diameter for square and triangle pitch with reference to STHE. **[10]**

Q.3 Define following terms for evaporator: **[10]**
(i) Capacity
(ii) Steam consumption
(iii) Economy
(iv) Boiling point elevation

OR

Q.3 Single effect evaporator is fed at a rate of 12000 kg/hr of solution containing 2% (w/w) solids. Thick liquor leaving the evaporator contains 30% (w/w) solids. If boiling point of solution is 70^0C and steam is available at 125^0C, calculate: (i) Steam consumption, (ii) Economy, and (iii) Heat transfer area. **[10]**
Data:
Temperature of feed = 28^0C
Latent heat of condensation of steam = 526 kcal/kg
Latent heat of vaporization of water = 540 kcal/kg
Specific heat of feed = 0.91 kcal/kg.^{0}C
Overall heat transfer coefficient = 1800 kcal/hr.m^2 ^{0}C

Q.4 Derive an expression for overall heat transfer coefficient (HTC) for mechanically agitated contactor (MAC) wherein heat energy is supplied through limpet coil to the content of MAC.

OR

Q.4 Enumerate any two empirical equations for HTC for a given impeller design. What is the effect of impeller speed on HTC?

Q.5 Derive an expression to estimate pressure drop in solid liquid fluidized bed (SLFB) in laminar regime. **[10]**

OR

Q.5 Enumerate Richardson- Zaki expression of velocity- voidage relationship. How can you measure voidage in SLFB experimentally? **[10]**

Q.6 Enumerate with neat sketch the components of furnaces **[10]**

OR

Q.6 Enumerate following with reference to furnace: **[10]**
(i) Thermal efficiency
(ii) Excess oxygen requirement
(iii) Lobo- Evans method

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