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

Day : Monday | Time : 02:30 PM-05:30 PM

Date : 28-11-2022 | **W-24442-2022** | 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 What is equivalent diameter (D_e)? Calculate D_e for heat transfer and pressure drop calculation for double pipe heat exchanger (DPHE) **[10]**

Data:

Inner pipe : i.d. = 25 mm, o.d. = 33.4 mm

Outer pipe : i.d. = 50 mm, o.d. = 60.33 mm

OR

Q.1 Calculate pressure drop in annulus region of DPHE. **[10]**

Data:

Inner pipe : i.d. = 25 mm, o.d. = 33.4 mm

Outer pipe : i.d. = 50 mm, o.d. = 60.33 mm

Mass flow rate = 2000 kg/hr

Density = 985 kg/m^3

Viscosity = 0.001 kg/m.s

Q.2 Enlist steps involved in design of shell and tube heat exchanger (STHE) using Kern method. Elaborate any two steps. **[10]**

OR

Q.2 Enlist the major components of STHE with neat sketch. Elaborate any two with reference to TEMA standards. **[10]**

Q.3 Establish mass balance and energy balance over single effect evaporator. **[10]**

OR

Q.3 An evaporator is fed at a rate of 8000 kg/hr of solution containing 4% (w/w) solids. Thick liquor leaving the evaporator contains 25% (w/w) solids. If boiling point elevation is 6^0C and steam is available at 125^0C, calculate: (i) Steam consumption, (ii) Economy, and (iii) Heat transfer area. **[10]**

Data:

Temperature of feed = 26^0C

Latent heat of condensation of steam = 526 kcal/kg

Latent heat of vaporization of water = 540 kcal/kg

Specific heat of feed = 0.95 kcal/kg.^{0}C

Overall heat transfer coefficient = 1500 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 jacket to the content of MAC.

OR

Q.4 Enlist system and operating parameters that affect HTC in MAC. Elaborate any one system parameter and operating parameter that affects HTC using any one empirical equation. **[10]**

Q.5 What is voidage in solid liquid fluidized bed (SLFB)? How can you measure voidage in SLFB experimentally by pressure drop method? **[10]**

OR

Q.5 Enumerate heat transfer characteristics of SLFB. Enumerate generalized empirical expression to determine HTC in SLFB. **[10]**

Q.6 Classify furnaces and enumerate control system in furnaces. **[10]**

OR

Q.6 Enlist methodologies to enhance thermal efficiency of furnaces. Elaborate any two methods. **[10]**

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