T-E- VI Sem- Chem

Heat Transfer Operations- II

20/05/2016

(31)

TE/VI/CBGS/CHEM/HTO

Q.P. Code : 729900

(Revised Course)

(3 Hours) [ Total Marks : 80

N.B. : (1) Question No. 1 is **compulsory.**
(2) Use of "**Heat Exchanger Databook**" is permitted.
(3) Attempt any **Three** out of remaining questions.
(4) Assume any suitable **data if necessary** and indicate it **clearly.**
(5) Draw neat **sketches wherever required.**
(6) Answer to the sub-questions of an individual question should be grouped and written.

1. (a) How do noncondensables affects condenser operation? 5
(b) List gasket materials used in plate heat exchanger with their respective applications. 5
(c) What, if fouling is not considered while exchanger design? 5
(d) Explain the working of kettle type reboiler with neat sketch. 5

2. There is a requirement to cool 160,000 Kg/hr of a ethanol from 70°C to 30°C. Cooling water will be used for cooling, with inlet and outlet temperature of 20°C and 60°C. Design a gasketed-plate heat exchanger for this duty with stainless steel (k= 15 W/mK) Plates of 0.5mm thick. Maximum operating pressure and allowable pressure for both fluids is 2 bar and 0.6 bar respectively and maximum permissible velocity is 3 m/s.Show one iteration of design calculation including thermal and hydrodynamic and if design is not satisfactory in 1irst iteration then comment on the calculations? 20

Data:

| Property | Cooling water | Ethanol |
|---|---|---|
| Specific heat, KJ/Kg.K | 4.179 | 2.46 |
| Viscosity, cP | 0.705 | 0.67 |
| Thermal conductivity, W/m.K | 0.62 | 0.171 |
| Density, Kg/m³ | 995 | 772 |

3. (a) Explain working of horizontal thermosyphon reboiler with schematic sketch. 12
(b) Explain operation of barometric condenser. 8

4. (a) What are the factors to be considered for allocation of fluid in shell or tube? 12
(b) Explain use of sealing strips in shell and tube exchanger. 4
(c) How do overdesign influence operation of heat exchangers like condenser, reboiler and coolers? 4



**Con. 11371-16.**

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5. A shell and tube heat exchanger has the following configration : 20
The shell side fluid is a hot water (mass flow = 7500 Kg/hr) with the following properties :

| | |
|---|---|
| Specific heat,Kcal/Kg.K | 4.3706 |
| Thermal conductivity, W/m.K | 0.5787 |
| Viscosity, cP | 0.3307 |
| Specfic gravity | 0.9673 |

Using Bell-Delaware method, calculate the shell side heat transfer coefficient for following data.

| | |
|---|---|
| Number of tubes | 34 |
| Shell Inner Diameter | 279.401 mm |
| Bundle diameter | 254.88 mm |
| Tube outer diameter | 25.4 mm |
| Sealine strips | None |
| Pitch 1.25Δ | 31.75 mm |
| No. of baffles | 35 |
| Baffle spacing (centre to centre) | 75mm |
| Baffle cut | 24.48% |

6. (a) 9150 Kg/hr of saturated cyclohexane vapour will be condensed at 83.33°C and 1.103 bar using a tube bundle containing 147 tubes arranged for singie pass. The tubes are 1 inch. Outer diameter. 14 B WG thickness with a length of 6096 mm.Calculate the condensing side coefficent for the tube .bundle is vertical and condensation occurs insides the tubes.Aiso calculate for horizontal condense with condi:nsation over tube,and comment on result. 16

Data:

| | |
|---|---|
| Density of condensate, Ke/m³ | 791.0 |
| Viscosity, cP | 0.3311 |
| Thermal conductivity, W/m.K | 0.1512 |
| Specific heat,KJ/Ke.K | 2.1562 |

(b) Explain operation of barometric condenser. 4