Q. P. Code: 22655

1T00516 - T.E.(CHEMICAL)(Sem VI) (CBSGS) / 36603 - HEAT TRANSFER OPERATIONS -II (HTO -II)

(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 together i.e. one below the other.

1. (a) What are the advantages of Plate Heat Exchanger? **(05)**
   (b) Explain working of reflux condenser with neat sketch. **(05)**
   (c) What, if fouling is not considered while exchanger design? **(05)**
   (d) Explain tube plugging in the context of overdesign of shell and tube heat exchanger. **(05)**

2. A 19,400 LPH condensate water need to be cooled from 65 °C to 45 °C before being discharge in an open trench, using cooling water available at 25°C.Temperature of cooling water at inlet of cooling tower should not exceed 42°C.It is decided to use Plate Heat Exchanger for thisDuty with stainless steel (k=15 W/mK) plates of 0.75mm thick.Maximum operating pressure and allowable pressure for both fluids is 3 barg and 0.7 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 first iteration then comment on the calculation? **(20)**
   Data:

Property	Cooling Water	Condensate
Specific Heat, KJ/Kg.K	4.179	4.183
Viscosity,Centipoise	0.705	0.504
Thermal Conductivity,W/m.K	0.6248	0.6493
Density,Kg/m^3	993.685	985.69

3. (a) Explain use of sealing strips in shell and tube heat exchanger. **(04)**
   (b) How do overdesign influence operation of heat exchangers like condenser, reboiler. **(04)**
   (c) Explain working of horizontal thermosyphon reboiler with schematic sketch. **(12)**

4. (a) What are the factors to be considered for allocation of fluid in shell or tube? **(12)**
   (b) How do you ensure negative pressure in furnace while design? **(04)**
   (c) List the gasket materials used in plate heat exchanger with their respective applications. **(04)**

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
Sealing strips	None
Pitch 1.25Δ	31.75 mm
No. of baffles	35
Baffle spacing (centre to centre)	75 mm
Baffle cut	24.48

6. (a) 9100 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 single pass. The tubes are 1 inch. Outer diameter, 14 BWG thickness with a length of 6096 mm.Calculate the condensing side coefficent for the tube bundle is vertical and condensation occurs insides the tubes.Also calculate for horizontal condense with condensation over tube,and comment on result. **(20)**
Data:

Density of condensate, Kg/m^3	791.0
Viscosity, cP	0.3311
Thermal conductivity, W/m.K	0.1512
Specific heat,KJ/Kg.K	2.1562

(b)Explain working of kettle type reboiler with neat sketch. **(04)**