Total No. of Questions : 10]

SEAT No. :

P3652

[Total No. of Pages : 2

[5560]-608
T.E. (Chemical)
CHEMICAL ENGINEERING DESIGN - I
(2015 Course) (Semester - II)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Explain hortonspheres in storage vessels. **[5]**

b) Explain Hydrostatic head at the bottom of the tank. **[5]**

OR

Q2) A tall vertical vessel 1.5 m in diameter and 13 m high is to be provided with the skirt support. Weight of the vessel with all its attachments is 80,000 kg. Diameter of skirt is equal to the diameter of the vessel. Height of skirt is 2.2 m. Wind pressure acting over the vessel is 100 kg/m^2. Seismic coefficient = 0.08, permissible tensile stress of skirt material = 960 kg/m^2, permissible compressive stress is 1/3 rd yield stress of material. Yield stress is 2400 kg/cm^2, estimate the thickness of skirt support. **[10]**

Q3) Explain the step-wise design procedure of shell and tube heat exchanger with neat diagram. **[10]**

OR

Q4) 0.8 kg/sec of furnace oil is to be heated from 10º to 90ºC in a shell and tube heat exchanger. Heating is done by steam available at 120ºC. Oil is circulated through the tubes. While steam is circulated in shell, tubes of 16.5 mm ID and 19 mm OD are available. Length of tubes = 3 m. The film coefficient of heat transfer for oil is 90 W/m^2 k while film coefficient of heat transfer for condensing steam is 7400 W/m^{2}k. Density of furnace oil 900 kg/m^3.

Specific heat of furnace oil = 1970 J/kg K

Fouling resistance for furnace oil = 0.0009 m^{2}k/W

Fouling resistance for steam side = 0.00005 m^{2}k/W.

Suggest a suitable design of the shell and tube heat exchanger.

Maximum oil velocity that can be used is 0.05 m/sec. Estimate the number of passes on tube side required in a heat exchanger. **[10]**

P.T.O.

Q5) a) For a forward feed triple effect evaporation system write the energy balance equations. **[8]**

b) In case of reboilers how the heat transfer coefficient is calculated for Pool boiling. Explain all the equations involved in the calculations. **[9]**

OR

Q6) a) Explain the design methods for mixed vapour condensers and how the true temperature difference is evaluated in such cases? **[8]**

b) Write note on flowing film evaporators. **[9]**

Q7) Design an agitator on the basis of critical speed of shaft with the help of neat Sketch & Explain different types of agitator in details. **[16]**

OR

Q8) Design a Decanter to separate a light oil from water. **[16]**

The oil is the dispersed phase.

Oil, flow rate 1000 kg/density 900 kg/m^3, viscosity 3 m Ns/m^2

Water, flow rate 5000 kg/h, density 1000 kg/m^3, viscosity 1 m Ns/m^2.

Q9) a) List different types of three phase separators and explain any two with neat sketches. **[10]**

b) Make a Preliminary design for a separators to separate a mixture of stream and water. Steam flow rate is 2500 kg/h and water flow is 1250 kg/h. Operating pressure is 4.2 bar. Liquid density = 950 kg/m^3.Vapour density =2.5 kg/m^3. Design the separators with demister pad. **[7]**

OR

Q10) Design steam water separator for following conditions: **[17]**

Steam flow rate : 2000 kg/hr

Water fow rate : 1000 kg/h

Density of water : 926.4 kg/m^3

Density of Vapour : 2.16 kg/m^3

Operating Pressure : 4 bar.