BE (Chem) Sem VII Rev-2012 CBSGS - PED 11.00-2.00
22/11/17

Q.P. Code: 25462

(3 hours) **Maximum marks: 80**

N.B.

1. Question no. 1 is compulsory.
2. Attempt any **three** questions out of remaining **five** questions.
3. Assume any suitable data wherever required.
4. Draw figures wherever needed.

Q1. Write short notes on any **four**. **(20)**

(a) Autofrettage
(b) Expansion bellow
(c) Baffles and tie rods
(d) Drum Filter
(e) Difference between U tube and fix tube heat exchangers

Q2. Design a U tube heat exchanger for the following data:

(i) **Shell side:**

Design pressure = 0.7 N/mm^2

Permissible stress for shell material = 100 N/mm^2

Standard torispherical head with knuckle radius as 10% of crown radius

25 % cut segmental baffles are provided

(ii) **Tube side:**

Number of tubes = 85

Tube outside diameter = 20 mm

Design pressure of tube side fluid = 2.5 N/mm^2

Permissible stress of tube material and tube sheet= 120 N/mm^2

Tubes pitch=Triangular

Length of the tube =3m

(iii) **Channel flange**

Material of construction same as shell

Gasket used : Flat Metal jacketed asbestos

With Gasket factor m = 5.5

Gasket seating stress y = 126 N/mm^2

Gasket for shell side flange

Flat Soft metal with Gasket factor = 3.75

Gasket seating stress = 53 N/mm^2

Corrosion allowance = 2 mm

Allowable stress for bolt material 140N/mm^2

Design for

(i) Shell (diameter and thickness) and torispherical head **(6)**

(ii) Flanges between shell and tube sheet **(6)**

(iii) Tube sheet thickness **(4)**

(iv) Channel and channel cover **(4)**

Q.3 Design a calendria type evaporator with the following data assuming that it has wire mesh for entrainment separation.

Evaporator drum under vacuum	External pressure 0.12 N/mm^2
Amount of water to be evaporated	31,000 N/hr
Heating surface required	400 m^2
Steam pressure	0.2 N/mm^2
Density of liquid	9950 N/m^3
Density of vapour	0.85 N/m^3
Effective tube length	1800 mm
Tube outside diameter	100 mm
Tube thickness	1.5 mm

Tubes laid on triangular pitch

Assume downtake pipe as 50% of the total tube cross sectional area

Permissible stress for evaporator material = 98 N/mm^2

Poisson's ratio 0.3

Modulus of elasticity for carbon steel = $2 \times 10^5 N/mm^2$

Modulus of elasticity for brass = $9.5 \times 10^4 N/mm^2$

Design the

(i) Calendria Diameter **(5)**

(ii)Tube sheet thickness **(6)**

(iii) Vapor drum diameter **(6)**

(iv) Top torispherical head **(3)**

Q.4(a) Show the symbols for the following components

(i) Ball mill (ii) Kettle Reboiler (iii) Centrifugal pump (iv) Autoclave

(v) Filter press **(5)**

(b)Write notes on

(i) Process flow diagram (ii) Piping and Instrumentation Diagram **(10)**

(c) Estimate the optimum pipe diameter for a water flow rate of 12 Kg/s at 20°C. Carbon steel pipe is used. Viscosity of water at 20°C is 1.1×10^{-3} Ns/m^2. Also find whether flow is laminar or turbulent. **(5)**

Q.5(a) Design the shell wall of a tall column with the following data: **(20)**

Shell inside diameter = 0.9 m

Shell length tangent to tangent = 20 m

Skirt height= 4m

Design pressure= 1.1 N/mm^2

Corrosion allowance= 3 mm

Tray spacing = 0.75 m

Top disengaging spacing = 1.5 m

Insulation thickness = 100mm

Specific gravity =7.7

Density of insulation per unit height=7700N/mm^3

Weir height = 75 mm

Weight of each head = 7.5 KN

Wind pressure = 1000 N/m^2

Weight of the liquid in Tray = 920 N/m^2

Permissible stress for shell wall material = 95N/mm^2

Weight of the pipe,ladder,plateform=1400N/m

Q. Q.6(a) Discuss design procedure of making high pressure vessel based on various theories of failure **(12)**

(b) Write notes on various types of construction of a high pressure vessel **(8)**

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