B.E - Chemical - Sem - VII (B) VII 15/5/17

Process Equipment Design (PED) Q.P. Code : 616701

(3 Hours) Marks : 80

A280612

ote : 1. Question no. 1 compulsory.
2. Attempt any th e questions out of remaining out of remaining five questions.
3. Assume any sui ible data wherever required.
4. Draw figures w erever needed.

. Write short notes on : y four. 20
(a) Autofrettage
(b) Drum Filter
(c) Entrainment sepai tors for evaporators
(d) Baffles and tie ro
(e) Inside and Outsid Packed Floating head type heat exchanger.

2. Design a Fixed tubesl et heat exchanger for the following d. ta:
Shell side:
Design pressure= 0.9 N/mm²
Permissible stress for hell material = 100 N/ mm²
Standard torispherica ead with knuckle radius as 6% of crown radius
25 % cut segmental b ffles are provided
Tube side:
Number of tubes= 40
Number of passes = 1
Tube outside diamete 20 mm
Design pressure of tu side fluid= 2.0 N/mm²
Permissible stress of be material= 120 N/mm²
Tube pitch = Square
Channel and channel over:
Material of constructi n same as shell
Joint with tube s eet- Ring facing
Ring gasket wid = 18 mm
Gasket factor= 5
Gasket seating s ss= 126 N/mm²

(a) Design
i) Shell (diame r and thickness) 6
ii) Flange joint tween channel and tubesheet 6
iii) Tube sheet th ckness 4
iv) Channel d channel cover thickness for a flat cover 4

[TURN OVER]

3. A high pressure vess of internal diameter 300 rnrn is to be designed to withstand an internal pressure of 150 N/mm². The permissible stress of the material is 300N/mm². Determi
   (a) The thickness of he monoblock cylinder with the desig based on Maximum principal stress t ory. 5
   (b) Assuming shrink it construction for the above designed vessel determine the stress distributio Take interface pressure as 50 N/mm² 10
   (c) Plot the stress di ribution for the above designed shrinl fit construction 5

4. Design a calendria ty evaporator with the following data a suming that it has wire mesh for entrain ent separation.

Evaporator drun	nder vacuum	External pressure 0.1 N/mm²
Amount of wate	o be evaporated	2,500 Kg/h
Heating surface	quired	300 mm²
Steam pressure		0.2 N/mm²
Density of liqui		995 Kg/mm³
Density of vapo		0.085 Kg/mm³
Tube length		1250 mm
Tube outside dia	eter	100 mm
Tube thickness		1.5 mm
Tubes laid on tri	gular pitch	
Assume down ta	pipe as 40% of the total tube cross sectional area	
Permissible stre	for evaporator material	= 98 N/ mm2
Poisson's ratio		0.3
Modulus of elast	ity for carbon steel	19 x 10⁴ N/mm²
Modulus of elast	ity for brass	9.5 X 10⁴ N/mm²

Design the
   (i) Calendria (Diamet and thickness) 6
   (ii) Vapor drum (Dia ter and thickness) 6
   (iii) Tubesheet thickn s 5
   (iv) Top torispherical ead 3

5. (a) Write the detail sign procedure of shell wall of a tall column for varying thickness. Desig must include all the stresses working on tall vessel. 15
   (b) Draw schematic iagram of tall vessel with plates 5

5

6. (a) Show the symbo for the following components
(i) Packed colun (ii) Spray dryer (iii) Centrifugal pump
(iv) Kettle reboil r (v) Ball mill 10

(b) rite notes on
(i) Process flow agram (ii) Piping and Instrumentation Diagram 5

(c) Estimate the opt ium pipe diameter for flow of ortho-dichlorobenzene with mass flow rate c 2.78 kg/s at 20° C. Carbon steel pip is used. Density of ortho-dichlorobe zene is 1306 Kg/m^3. Viscosity of orthodichlorobenzene at 20° C is 0.9 x 1(Ns/m^2. Also find whether flow is lam nar or turbulent.
