P P SAVANI UNIVERSITY

Sixth Semester of B. Tech. Examination

May-June 2022

SECH3062 Process Equipment and Design-I

24.05.2021, Tuesday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures with **Pencil** wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1 (a) Write a note on General Design Procedure for Chemical Equipment. **[05]**

Q - 1 (b) What do you mean by Gasket and state different types of Gaskets and explain any one in brief. **[05]**

Q - 2 Design a pressure vessel subjected to internal pressure for the following data: **[10]**

(a) Shell and head data:

Design pressure	= 5 Bar
I.D. of Shell	= 1000 mm
Permissible stress for shell and head	= 140 N/mm^2
Crown Radius	= 1000 mm
Corrosion allowance	= 2 mm
Double welded Butt joint, Shell	= 0.85
Head	= 1

(b) Flange, gasket and bolt data:

Gasket Factor	= 3.75
Minimum design gasket seating stress	= 52.5 N/mm^2
Flange material is same as shell material.	
Permissible stress for bolt material	= 138 N/mm^2
Bolt size M20 x 2 with root area	= 200 mm^2

Design should include: (a) Shell, (b) Torispherical head and (c) Flanged joint.

OR

Q - 2 (a) Explain Principle, construction and working of Basket Centrifuge. **[06]**

Q - 2 (b) Write the notes on: (i) Types of nozzle and (ii) Welded joints and types. **[04]**

Q - 3 Design a reaction kettle for the following data: **[10]**

Vessel shell I.D.	= 500 mm
Jacket I.D.	= 575 mm
Jacketed side and bottom head with Straight side jacket length	= 500 mm
Design Pressure, Shell & Jacket	= 2 Bar
Design Temperature (Shell and Jacket)	= 150 °C
Torispherical head, Crown Radius	= 500 mm
Knuckle Radius	= 50 mm
MOC: Steel (IS 2062) for Shell, head and jacket.	
Allowable stress	= 95 N/mm^2
Modulus of Elasticity	= 1.9 x 10^5 N/mm^2
Poisson's Ratio	= 0.3

IS 2825, B at 150 °C = 12500
Factor of Safety = 4

OR

Q - 3 A cylindrical vessel of 1200 mm I.D. is subjected to an internal pressure of 0.7 N/mm^2. Design the reinforcing pad for an opening, if required for the following data: **[05]**

I.D. of seamless nozzle pipe	= 150 mm
Thickness of nozzle wall	= 4 mm
Thickness of vessel wall	= 6 mm
Corrosion allowance	= 2 mm
Height of nozzle above vessel wall	= 100 mm
Permissible stress of the vessel and nozzle material	= 130 N/mm^2

Reinforcing material is same as that of vessel = 6 mm and available in thickness
Joint Efficiency, Shell= 0.85
Head/ Nozzle = 1.

SECTION – II

Q – 1 (a) Explain the Shell and Tube type heat exchanger in terms of following points: (a) Baffle Type and Geometry, (b) Tubes and Tube Passes, (c) Tube Layout and (d) Fluid allocation. **[07]**

Q - 1 (b) What are the different specifications to be given to design experts for distillation column? **[03]**

Q - 2 (a) Explain forced circulation evaporators and draw the diagram of two types. **[07]**

Q - 2 (b) Explain Mier's Theory of supersaturation. **[03]**

Q - 3 (a) Classify different types of evaporators and draw forward feed triple-effect evaporator. **[05]**

Q - 3 (b) Explain different parts of Plate and Frame Heat Exchangers. **[05]**

OR

Q - 3 (a) State the purpose of evaporation and processing factors for the same. **[05]**

Q - 3 (b) Explain the basic equipment for construction of distillation column. **[05]**

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