GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII(NEW)   EXAMINATION – SUMMER 2019

Subject Code: 2170502   **Date:14/05/2019**

Subject Name: Process Equipment Design -II

Time: 02:30 PM TO 05:30 PM   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Give the full name of ASTM, ASME & HTRI.	**03**
	(b)	Write a short note on corrosion allowance.	**04**
	(c)	Define the terms: Stress, Strain, Ductility, Rigidity, Elasticity, Creep, Resilience	**07**
Q.2	**(a)**	What is design stress and factor of safety? Explain in brief.	**03**
	(b)	Describe in brief about design pressure & design temperature.	**04**
	(c)	Enlist various types of fabrication techniques used in industries for the designing of equipment. Explain any one in detail.	**07**

OR

	(c)	Discuss in detail about various types of static and rotary equipments used in industry.	**07**
Q.3	**(a)**	Discuss the use of jackets and coils in the industry.	**03**
	(b)	What do you mean by weld joint efficiency factor? Discuss in brief.	**04**
	(c)	Explain the stepwise procedure for the design of conical roof with structural support for storage tank.	**07**

OR

Q.3 Data for pressure vessel are given below: **14**

- Capacity : 10000 L (cylindrical portion only), Operating pressure = 10 kgf/cm^2
- f = 980kg/cm^2, Density of steel = 7.7gm/cc, J = 0.85
- Torspherical heads are provided at both sides.
- For torispherical head, R_c = 10% excess of I.D., R_1 = 10% of R_c

Taking L/D = 5, calculate and suggest the plate thickness of shell.

Also calculate the thickness & weight of torispherical head.

Q.4	**(a)**	Discuss the term: Poisson's Ratio, Modulus of elasticity and Power number.	**03**
	(b)	Discuss about the design Saddle support.	**04**
	(c)	State the various types of agitators. Discuss the design aspects of any two in details.	**07**

OR

Q.4 Calculate the thickness of shell of the reactor and thickness of jacket for the following available options (i) Reactor with plain jacket and (ii) Reactor with channel jacket. Following data are available.   **14**

- Inside diameter of shell = 1500 mm, Inside diameter of jacket = 1600 mm
- Shell length=1500 mm, Half coil diameter = 75 mm, Width of channel jacket = 75 mm,
- Internal design pressure for Shell & Jacket= 4 kgf/cm^2 & 3 kgf/cm^2
- Design temperature for both shell and jacket 150 °C
- Max. Allowable stress = 980 kgf/cm^2, Modulus of elasticity, E = 19×10^5 kgf/cm^2
- Poisson's ratio, μ = 0.3, Joint Efficiency J = 0.85

Thickness of Shell $t = \dfrac{P D_i}{2 fJ - P} + CA$, Thickness of plain jacket $t = \dfrac{P r_i}{fJ - 0.6P} + CA$

$$f_{PS} = \frac{P' Di}{2 t_{S}'} + \frac{P \, di}{4 t_{C'} + 2.5 t_{s'}} , \quad f_{AS} = \frac{P' Di}{4 t_{S}'} + \frac{P di}{2 t_{C}'} + \frac{2 \Delta P d_{o}^2}{3 t_{S}^2}$$

Q.5 **(a)** Define Gasket seating stress and gasket factor. **03**
(b) State different types of gasket used in chemical industries. **04**
(c) Examine the data given below to evaluate the requirement of compensation for the **07** nozzle opening in a cylindrical shell. If compensation ring (Reinforcement pad) is required then find its dimensions and weight.
- Outside diameter of shell = 2 m
- Max. Working pressure within shell = 3.5 MN/m^2
- Wall thickness for the shell = 0.05 m, Corrosion allowance = 3 mm
- Joint efficiency = 1 (for shell and nozzle), Length of nozzle = 100 mm
- MOC of shell, nozzle and reinforcement pad = IS 2002
- Density of IS 2002 = 7800 kg/m^3, Allowable stress of IS 2002 = 96 MN/m^2
- O. D of nozzle (seamless) = 0.25 m, Nozzle wall thickness = 0.016 m

OR

Q.5 **(a)** Discuss in brief about Radiography test used for welding. **03**
(b) Describe various types of jackets and their selection criteria. **04**
(c) Discuss the types of support used in industry. **07**

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