11043 : Process Equipment - Design & Drawing : 6 CT 01

P. Pages : 2 AW - 3257

Time : Three Hours * 0 7 3 9 * Max. Marks : 80

Notes :
1. Answer **Three** question From Section "A" and **Three** question from Section "B"
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemicals equations should be given wherever necessary.
5. Illustrate your answer necessary with the help of neat sketches.
6. Use of slide rule logarithmic tables, Steam tables, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
7. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) What do you mean by material failure? Explain the various theories proposed for failure. 6

   b) When lining becomes necessary for process equipment's? How is lead lining carried out? 7

OR

2. a) Explain the term stress and strain. What do you mean by yield point of a material? 6

   b) What are non-ferrous alloys? Explain with suitable examples. 7

3. a) Why spherical vessels are better as compared to cylindrical vessels? A cylindrical shell of a vessel has an inside diameter 1.5 m and is subjected to an internal pressure 3.5 kg/cm^2. Allowable tensile stress of a material is 960 kg/cm^3. Calculate the required thickness and corresponding deflection. 7

   b) How to design a pressure vessel subjected to external pressure? Explain the importance of stiffening rings. 6

OR

4. a) How to design a pressure vessel subjected to internal pressure and how to determine the equivalent resultant stress in the vessel due to all the stresses? 7

   b) What are the various types of jackets used for pressure vessels? Draw the neat sketches. 6

5. a) How to design a high pressure vessel by shrink fit technique? Explain. 7

   b) A multilayer vessel is to be operated at 133.3 MN/m^2 and is to be fabricated by using three shells. Inside diameter of vessel is 30.5 cm while outside diameter is 59.5 cm. The vessel is fabricated by shrink fit construction. The interface diameters are 38.1 cm and 47.6 cm. respectively. Determine the maximum combined stress at the interface, interface pressures. 7

OR

6. a) How to design a shaft for an agitator? 7

   b) What are the different types of agitators? Draw their neat sketches and explain their applications. 7

SECTION – B

7.	a)	A tall vertical vessel 2.2 m in outside diameter and 34m in height has a shell thickness 14mm. Corrosion allowance is not necessary. The vessel is insulated with 80 mm thick magnesia insulation. The vessel has no attachments. Wind force acting over the vessel is 128 kg/m^2. Weight of the vessel = 91000 kg. Calculate the bending moment induced in the vessel and estimate the resulting bending stress. $k_1 = 0.7$ and $k_2 = 1.0$ for the vessel.	7
	b)	What are the different types of nozzles and how to decide the safe reinforcement limit?	7
		OR	
8.	a)	How to design safe reinforcement for a nozzle? The nozzle do not protrude inside the vessel.	7
	b)	What are saddle supports? Explain their design procedure and applications.	7
9.	a)	How to determine optimum proportions of a large storage tank where shell thickness is dependent on diameter and height of the tank.	7
	b)	A cylindrical storage tank has diameter 30 m and the tank height is 12 m. Liquid stored in the tank has a density 810 kg/m^3. Material of construction is carbon steel having permissible stress 1300 kg/cm^2. Density of material used for fabrication is 7700 kg/m^3. Plates of size 3m × 1.2m are available for fabrication. Welded joint efficiency is 85% and corrosion allowance is not necessary. Calculate the cylindrical shell thickness of the tank and estimate the total number of plates required for fabrication of cylindrical shell of the tank. An allowance of 2mm is provided between two adjacent plates to facilitate welding.	6
		OR	
10.	a)	What are the different types of roofs used for the storage tanks.	7
	b)	Discuss in detail mechanical design of a cylindrical storage tank.	6
11.	a)	What is schedule number? Explain its significance.	7
	b)	Water is flowing through a pipeline at a rate of 1 kg/sec. The internal diameter of pipeline is 25mm and the length of pipeline is 2200m. Estimate the pressure drop in pipeline? Density of water = 1000 kg/m^3. Viscosity of water = 1×10^{-3} N-s/m^2.	6
		OR	
12.	a)	How to prepare a piping diagram for a chemical process plant? Explain with suitable example.	7
	b)	How will you decide pipe diameter for an allowable pressure drop and desired flow rate?	6

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