

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2170502

Date: 26/11/2019

Subject Name: Process Equipment Design -II

Time: 10:30 AM TO 01:30 PM

Total Marks: 70

Instructions:

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

		MARKS
Q.1	(a) Discuss the following: (i) internal design pressure (ii) external design pressure (iii) design temperature	03
	(b) List the basic mechanical properties which a material should possess and explain any three of them?	04
	(c) Explain in brief about classification of unfired vessel as per IS-2825	07
Q.2	(a) List the various standard flanges and different types of gaskets. Also draw a neat sketch of any one flange facing.	03
	(b) Discuss the design steps for pressure vessel for Torispherical head subjected to internal pressure.	04
	(c) Examine the data given below to evaluate the requirement of reinforcement pad for the nozzle opening in cylindrical shell. OD of shell = 2 m, maximum working pressure within shell = 3.5 MN/m ² , thickness of shell = 0.05 m, corrosion allowance = 3 mm, joint efficiency of nozzle and shell = 1, MOC = IS 2002, Allowable stress = 96 MN/m ² , Density = 7800 kg/m ³ , OD of nozzle = 0.25 m, Nozzle wall thickness = 0.016 m, length of nozzle = 100 mm.	07
	OR	
	(c) A tower having 4.5 m inside diameter & 8 m length from tangent line to tangent line of the end closers. Tower is operated under vacuum. Tower shell is constructed from SA-283 grade-B carbon steel plate, which has yield strength of 1898.4 kgf/cm ² . Determine the required thickness of shell without stiffeners. Assume 8 mm thick plate.	07
Q.3	(a) Explain radiography test.	03
	(b) Discuss in brief about the various types of fabrication technique used for the fabrication of pressure vessel.	04
	(c) Discuss about different types of jackets with neat sketches of each.	07
	OR	
Q.3	(a) Give full form of TEMA, ASME and HTRI	03
	(b) Explain in brief the various pressure tests carried out for the design of pressure vessel.	04
	(c) Discuss about different types of agitators and their selection criteria.	07
Q.4	(a) Give the function of tube sheet, shell side partition and tube side partition in a heat exchanger.	03
	(b) Write in short about the mechanical design of shell and tube heat exchanger.	04
	(c) A fixed conical roof storage tank is fabricated from structural steel plate (IS – 2062). Based on the given following data find out the thickness of conical roof plate and size of roof curb angle. Storage tank can be classified as 'Class A Tank'.	07

Given Data:-

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Tank diameter = 7m

Tank height = 5m

Slope of conical roof = 1/6

Superimposed live load on roof = 125 kgf / cm²

Modulus of elasticity of Plate material = 2x10⁶ kgf /cm²

Density of Plate material = 7800 kg / cm³

Poisson's ratio = 0.3

Thickness of topmost shell course = 10 mm

Minimum size of roof curb angle = 65 mm x 65 mm x 6 mm

OR

Q.4 (a) Give the function of baffles, tie rod, sealing strip in a heat exchanger. **03**

(b) The shell & tube heat exchanger has the following data: **04**

Shell inside diameter = 580 mm

Tube O.D. = 19.05 mm ; Thickness of tube = 1.65 mm

Internal operating pressure of shell side = 2.0 kgf/cm²;

Internal operating pressure of tube side = 6.0 kgf/cm²

Allowable stress for shell and tube material = 1054 kgf/cm²

Material of shell : SA 312 TP 304 (seamless pipe)

Material of tube : SS 304; Density of SS 304 = 8000 kg/m³

J =1

Mean diameter of gasket = 550 mm

No. of pass on tube side = 2; Depth of pass partition plate = 5 mm

Calculate:

- Thickness of shell
- Thickness of tube

Use only internal design pressure. Neglect the thickness calculation by external design pressure.

(c) Discuss the various steps used for design of column supported conical roof. **07**

Q.5 (a) What is meant by a bracket? How many brackets are required, if vessel diameter is < 5 m & >5 m? **03**

(b) Write a short note on Tray supports used for distillation column. **04**

(c) Discuss the design of bracket support **07**

OR

Q.5 (a) Answer in True or False for the following statements **03**

- Short vertical cylindrical vessels are generally supported by bracket support.
- Saddle support and Skirt support are same.
- Tall vertical vessels are supported by Lug support.

(b) Explain the design procedure for saddle support. **04**

(c) Find the thickness of a straight cylindrical skirt support for distillation column based on following data. **07**

Diameter of column = 2500 mm; Height of distillation column = 40 m;

Max. weight of vessel, its attachment & contents = 300000 kg

Diameter of skirt = 2500 mm; Height of skirt = 5 m; Wind pressure at the top of column = 128.5 kgf/m²; Material used for skirt support = IS 800 structural steel; Max. allowable tensile stress = 1400 kgf/cm²; Max. allowable compressive stress = 666 kgf/cm²; Max. allowable bending stress = 1575 kgf/cm²; Seismic coefficient = 0.08; Minimum wt of empty vessel = 250000 kg
