

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: 170502**Date: 05/12/2013****Subject Name: Process Equipment Design-II****Time: 10:30 TO 01:30****Total Marks: 70****Instructions:**

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

Q.1 Discuss the design steps for pressure vessel for (i) cylindrical shell subjected to internal pressure (ii) cylindrical shell subjected to external pressure (iii) Torispherical and Elliptical head subjected to internal pressure. **14**

Q.2 (a) What is reinforcement pad? Explain the area for area method for calculating dimensions of reinforcement pad. **07**

(b) With a neat sketch discuss various types of Flange facings used in reaction vessel. **07**

OR

(b) List out the types of jackets. Discuss design of channel jacket and half coil jacket. **07**

Q.3 A storage tank (Class-A) is having following data: **14**

Tank diameter : 30 m

Tank height : 18 m

Sp. Gr. Of liquid: 1.18

Conical roof slope – permissible 1 in 5

Superimposed load - 125 kg/m²

Material – carbon steel (structural)

Permissible stress : 980 kgf/cm²

Density of plate material : 7800 kg/m³

Modulus of elasticity: 2×10^6 kg/cm²

Standard plate size = 1.8 m width x 6.3 m length

Design the shell and bottom. Verify that self-supporting conical roof can work for this storage tank or not?

OR

Q.3 Discuss the various steps used for design of column supported conical roof. **14**

Q.4 (a) Discuss with a neat sketch various types of flanges. **07**

(b) Discuss the method of design for loose flange for reaction vessel. **07**

OR

- Q.4** The shell & tube heat exchanger has the following data: **14**
 Shell inside diameter : 596.9 mm
 Tube o.d. = 19.05 mm
 Thickness of tube = 1.65 mm
 Internal operating pressure of shell side = 3.0 kgf/cm^2
 Internal operating pressure of tube side = 6.0 kgf/cm^2
 Allowable stress for shell and tube material = 1054 kgf/cm^2
 Material of shell : SA 312 TP 304 (seamless pipe)
 Material of tube : SS 304
 Density of SS 304 = 8000 kg/m^3
 Mean diameter of gasket = 673 mm
 No. of pass on tube side = 2
 Depth of pass partition plate = 5 mm
 Calculate:
 thickness of shell
 thickness of tube
 thickness of head
 blank diameter and weight of head
 thickness of tube sheet.
 Use only internal design pressure. Neglect the thickness calculation by external design pressure.
- Q.5** Write Short notes: (*any two*) **14**
 Saddle support
 Skirt support
 Gaskets
- OR**
- Q.5** A distillation column has following data: **14**
 Shell outer diameter at top = 2000 mm
 Shell length tangent line to tangent line = 24 meter
 External design pressure = 1.033 kgf/cm^2
 Design temperature = 120°C
 Shell material = SA 283 Gr C
 Joint efficiency = 85%
 Skirt height = 4 m
 Tray spacing = 0.3 m (106 trays)
 Top disengagement space = 1.2 m
 Weight of liquid and tray = 120 kg/m^2
 Weight of attachment(pipes, ladders & platform) = 150 kg/m
 Wind pressure = 130 kg/m^2
 Insulation thickness = 100 mm
 Density of insulation = 500 kg/m^3
 Allowable stress = 890 kgf/cm^2
 Modulus of elasticity = $2 \times 10^6 \text{ kgf/cm}^2$
 Poisson's ratio = 0.3
 Corrosion allowance = 2 mm
 Sp. Gr. of shell material = 7.865
 Neglect the stress created by eccentric load and seismic load. Calculate the thickness of shell plate for entire tower.
