Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER IV (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2740803 **Date:04/05/2016**

Subject Name: Pressure Vessel and Piping System Design

Time:10:30 am to 01:00 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		Derive the necessary equations for designing skirt bearing plate for supporting the tall vertical vessel by considering	
	(a)	The tension side, and	**07**
	(b)	The compression side.	**07**
Q.2	**(a)**	How the bolting area and bearing plate width are determined for the foundation of tall vertical vessel?	**07**
	(b)	Write short notes on ASME section VIII Division I, II and III	**07**
		OR	
	(b)	Discuss the stress categories according to ASME code.	**07**
Q.3	**(a)**	Derive the stress-curvature relation for rectangular plate	**07**
	(b)	Determine the deflection of a circular plate of radius *a* carrying uniformly distributed load *q* if its outer edge is having fixed support.	**07**
		OR	
Q.3	**(a)**	Derive the basic relation of determining the membrane stresses produced by internal pressure in shells of revolution.	**07**
	(b)	Derive the equations for determining the discontinuity stress in the cylindrical shell when subjected to internal pressure.	**07**
Q.4	**(a)**	Define the following terms 1. Design pressure 2. Working pressure 3. Maximum allowable stress value 4. Required and design thickness	**07**
	(b)	A vessel having cylindrical shell and conical section as an end closure. Design the pressure vessel using internal pressure and check against external pressure • Internal pressure = 0.7 MPa • Allowable stress = 120 MPa • Weld joint efficiency = 1 • Inside radius of shell and conical section = 2500 mm • Outside diameter of small end of cone = 1270 mm • Cone angle = 30^0 • External pressure = 0.1 MPa • Modulus of elasticity = 186161.3 MPa • Length of shell section = 4 m • Factors for cylindrical shell A = 0.0005, B = 51.72 • Factors for conical head A = 0.001, B = 75.86	**07**
		OR	
Q.4	**(a)**	Derive the differential equation for the deflection curve for a thin circular ring when subjected to external pressure.	**07**
	(b)	Explain the design procedure of stiffening ring for cylindrical pressure vessel.	**07**
Q.5	**(a)**	A cylindrical pressure vessel of 1250 mm inner diameter and 20 mm thickness is provided with nozzle of 200 mm inner diameter and 15 mm thickness. The extension of the nozzle inside the vessel is 15 mm. The corrosion allowance is 2	**07**

mm, while the weld joint efficiency for the shell and the nozzle is 0.85. The design pressure is 3 MPa. The yield strength of the material for the shell and the nozzle is 200 MPa. Factor of safety is 1.5. Determine whether or not a reinforcement pad is required for the opening.

(b) Explain different types of pipe joints used in common practice. **07**

OR

Q.5 **(a)** A pipe with 50 mm and 75 mm as inner and outer diameters respectively is reinforced by a shrinking a jacket with an outer diameter of 10 mm. The compound pipe is to withstand an internal pressure of 35 MPa. The shrinkage allowance is such that the maximum tangential stress in each pipe has same magnitude. Calculate **07**

1. The shrinkage pressure, and
2. The original dimensions of pipes

Show the distribution of tangential stresses. Assume E = 207 kN/mm^2

(b) Discuss the various piping codes and standards **07**

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