



RM-7853

B. E. IV (Sem. VIII) (Mech.) Examination

May / June - 2010

Design of Pressure Vessel & Piping

(Elective - II)

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

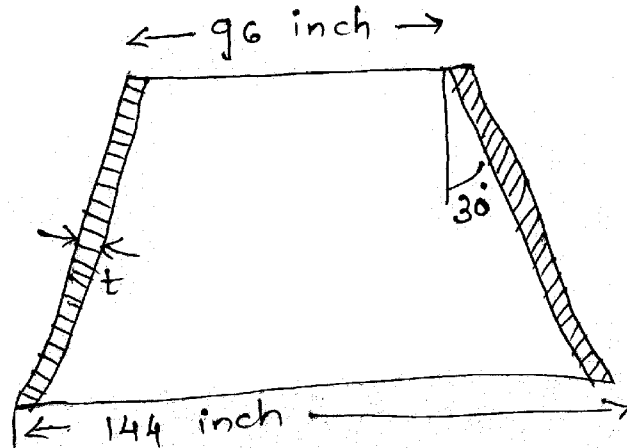
नीचे दशांशिक निशानीवाणी विगतो उत्तरवही पर अवश्य लખवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. - 4 (Sem. 8) (Mech.)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Design of Pressure Vessel &amp; Piping"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="8"/> <input type="text" value="5"/> <input type="text" value="3"/>	Section No. (1, 2,...): <input type="text" value="1&amp;2"/>
Student's Signature	

- (2) Q.1 is **compulsory** and attempt any **two** questions out of Q. 2, Q. 3, Q. 4. from section-I.
- (3) Figures to the **right** indicate full marks.
- (4) Use of design data book is permitted.
- (5) Assume suitable data if required.
- (6) Q. 5 is compulsory and attempt any two questions from Q. 6, 7, and 8 from section-II.

### SECTION - I

- 1 (a) Answer the following : 10
- (i) What is membrane stress?
  - (ii) What is out of roundness of shell?
  - (iii) What is pressure vessel? Give its classification.
  - (iv) Give various conditions when skirt may fail.
  - (v) Why stiffening rings are provided to the vessel?

- (b) (i) Check the conical head section thickness 0.375 inch is satisfactory for the following data. External design pressure = 15 PSI, material of the cone SA 285-C and 500°F design temperature. 6



- (ii) Explain various methods for construction of head. 4

- 2 (a) Explain purging of vessels. 5
- (b) Write the basic equation for the theory of membrane stresses in vessel under internal pressure and explain each term by using this equation; derive the equation of hoop stress and longitudinal stress for cylindrical, spherical and conical pressure vessel. 15

- 3 Design a flange for the following data : 15

- Operating pressure = 7.79 N/mm<sup>2</sup>
- Gasket = spiral wound, stainless
- Stress intensity for flange at = 172.38 N/mm<sup>2</sup> atmosphere temperature
- Stress intensity for flange at 152.24 N/mm<sup>2</sup> operating temperature
- No. of bolts = 20

$A$	$k_1$	$E$	$t$	$R$	$d_1$	$C$	$N$	$B$	$God$	$h$
704.85	406.4	508	89	469.9	41.275	615.95	22.225	381	457.2	127

All dimensions are in mm.

4	Design a base ring of tall vertical vessel for the following specifications :	15
-	Modulus of Elasticity ratio	12
-	Poisson's ratio	0.3
-	Base ring Inside diameter	4115 mm
-	Bolt corrosion allowance	3.175 mm
-	Maximum tensile stress on upwind side	137.94 N/mm <sup>2</sup>
-	Maximum compressive stress in concrete	8.28 N/mm <sup>2</sup>
-	Basering width	355.6 mm
-	Bolt circle diameter	4572 mm
-	No. of bolts	36
-	Total root area of bolt	186301 mm <sup>2</sup>
-	Maximum bending moment due to wind	591171055 N.mm
-	Operating weight	49523.74 N
-	Width of the Basering outside skirt	218 mm

## SECTION - II

- |   |  |    |
|---|--|----|
| 5 | (a) Answer the following :   | 10 |
|   | (i) Define the primary and secondary stresses.   |    |
|   | (ii) Explain major losses  |    |
|   | (iii) Explain hydraulic gradient line Q total energy line  |    |
|   | (iv) What is Auto freetage?  |    |
|   | (v) State minor energy losses in pipes.  |    |
|   | (b) The cylindrical shell is subjected to design pressure of 250 Psig. The allowable stress for plate material is 14400 Psi and C.A. is 0.125 inch. Spot radio graphed double welded butt joint are used to fabricate the weld whose I.D. is 4 feet. Take weld joint efficiency for shell 85% Hemispherical head with radius of 2 feet are used as end closures, head are seamless. Determine the thickness of the cylindrical shell and hemispherical head. |    |

- 6 (a) Derive the equation for principal stresses of thick cylinder subjected to internal pressure only. 10  
(b) Explain types of head. 5
- 7 Design a multilayer vessel subjected to internal pressure of 100 MPa. I.D. of vessel is 100 mm. Take diameter ratio = 1.5 and is constructed of three shells. Determine and draw the stress variation for multilayer vessel. Also draw stress distribution by taking vessel as simple mono block. 15
- 8 Design reinforcement for following data : 15  
ID of shell = 7900 mm  
Int. design pressure = 0.517 MPa  
Allowable stress for shell = 103.42 MPa  
Allowable stress for Nozzle = 95.15 MPa  
Shell thickness = 60 mm  
Nozzle thickness = 40 mm  
Nozzle I.D. = 900 mm  
Filled Weld = 9 mm  
Extension of nozzle inside vessel = 27.43 mm
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