

Any more data required should be assumed

MM: 30

Q1. (a) What is the difference between the thin and thick pressure vessel? Explain in terms of the stresses developed in these when internally pressurized.

(b) What is the thickness required of a 2 m inside diameter cylinder, considering it as a thin walled vessel, to withstand an internal pressure of 5 Mpa if the allowable tangential (hoop) stress is 150 Mpa?

(5+5)

Or

Determine the minimum shell thickness of a vacuum crude tower of 6 m nominal diameter and 8 m length from tangent line to tangent line. Assume the material of the shell plates to be low-carbon-steel and an operating temperature of 425° Celsius. Use the design chart provided from Appendix F of IS code 2825. Mark the design point(s) on the chart.

Explain briefly why it would be desirable to have stiffeners for the vessel?

(10)

Q2. A 250 mm inside diameter 12 mm thick tube is bent into a 4 m diameter torus which is to be subjected to an internal pressure of 20 Mpa. What are the maximum and minimum tangential (hoop) stresses in the torus. Also Indicate their locations on a diagram.

Discuss the nature of variation of maximum hoop stress with the ratio of diameters (torus/tube).

(10)

Q3. Consider the cylindrical vessel of Q1(b). For a semi-ellipsoidal head of the cylindrical vessel of radius r and uniform wall thickness h , determine the maximum shear stress developed in the head when the ratio of the major to minor axis (a/b) is 2.0. The vessel is subjected to an internal pressure of p . (take data from Q1(b) assuming a wall thickness $h = 50$ mm).

Discuss the nature of variation of meridional, hoop and shear stresses in the semi-ellipsoidal head from the crown to knuckle region.

What are the various possible modes of failure of the vessel?

(4+3+3)

Mech. Engg. Deptt.

INDIAN INSTITUTE OF TECHNOLOGY DELHI

Minor Test I - IIInd Semester 2017-18

MCL 743: PLANT EQUIPMENT DESIGN

on 5.2.2018 (Monday) , LH526, 14:30-15:30

Course Coordinator/Faculty : Prof. K.Gupta/Prof T.K.Kundra

Max. Marks 60

Notes: Attempt Part A and Part B on Separate answer books

Part A

- 1 [a] Explain the meaning of plant equipment design. List also the four steps to design any equipment.
[b] How the cutting force in a machine tool equipment causes errors in machining. Illustrate.
[c] How the stiffness of an equipment should be improved? Explain.
[d] Describe briefly how would you ensure dynamic soundness of a machine tool equipment?

[5,10,5,10]