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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2016

Mechanical Engineering

(Machine Design)

01ME 6104 Design of Pressure Vessels and Piping

Max. Marks : 60 Duration: 3 Hours

Answer any two full questions from Part A,B&C

Part A

1)Derive a relation for the membrane stresses in vessels under internal pressure? Hence arrive at a relation for the hoop and longitudinal stress in a torus vessel under internal pressure? Also plot the variation of hoop stress around the torus? (9)

2) a)A compound cylinder is made by shrink fitting a tube of 200mm internal dimeter and 30mm thickness to an external tube of 40mm thick. Before shrink fitting there was a radial clearance of 0.03mm between the tubes. Find the radial pressure and also plot the final stresses if the tube was subjected to an internal fluid pressure of 20N/mm2. E = 200GPa and Poisson ratio = 0.3. (9)

3) a) Name all the sections of ASME design of pressure vessel code (2)

b) Explain why the half cone angle of conical cover is limited to 30°(1)

c) What are the methods to prevent local buckling in elliptical heads?(1)

d) A cylindrical shell 10m long and 1.5m internal diameter has 25mm thickness. Calculate the circumferential and longitudinal stresses induced and also determine the change in diameter and change in length, if the internal pressure is 200N/cm^2. Take E=200GPa, and v=0.3 (5)

Part B

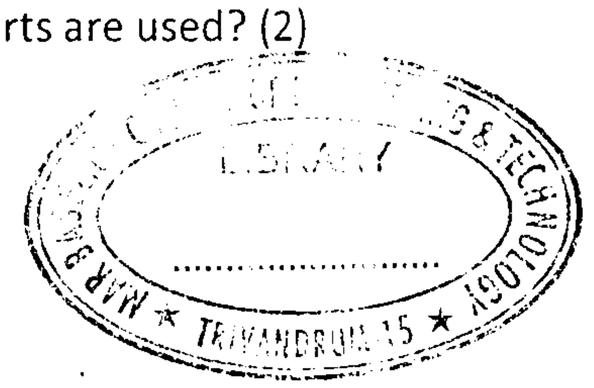
4)Do the reinforcement analysis for the following data. Inside diameter of shell 125cm. Design pressure 25Kg/cm^2 at 125°C. Allowable stress for shell and nozzle materials are 440MPa. Thickness of shell is1.5cm and that of nozzle is thickness 1cm. Nozzle inside diameter is 10cm. Extension of nozzle inside vessel 2.5cm. Fillet weld size is 1cm of equal leg size. Number offillet welds are 4. (9)

5) a)Explain the terms operating pressure, design pressure, maximum allowable working pressure, and hydrostatic test pressure with reference to pressure vessel (2)

b) Explain the nature of stress on the windward and leeward side of a vessel under internal pressure, external pressure, wind load and self-weight? (2)

c) Sketch different supports used in vessels? Where each of these supports are used? (2)

d) Explain the steps involved in earthquake analysis of a vessel?(3)



6) Design a tall vessel for the following conditions

Inside diameter = 2.5m, Outside diameter including insulation 2.8m, Height of the vessel = 30m, Distance from base to bottom shell joint =1.6m, Internal pressure = 25Kg/cm2, wind load = 0.1kg/ cm2, Allowable stress of the material = 250MPa. Vessel has a platform 2m below the top and a ladder starting from platform to the shell bottom joint. The vessel is fully radiographed.(9)

Part C

7) Derive the equation for finding critical pressure of a thin vessel under external pressure. Hence find the critical pressure equation for failure if the vessel is acted upon by two equal and opposite external forces? (12)

8) a) Explain the terms SIF, allowable stress range and displacement stress range?(4)

b) Explain the steps involved in external pressure design of a thin vessel following ASME code? Explain the various factors and plot the graphs used?(5)

c) Explain different types of flanges used in piping application?(3)

9) a) Explain four common joining techniques used in pipes? (2)

b) Do the flexibility analysis for the following pipe configuration? A two anchor routing pipe 25cmouter diameter has length of 10meach in x, y and z directions. Expansion of pipe is 2.5cm/100m. (10)