UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

MEC 3351 – STRENGTH OF MATERIALS I
Assignment – Thin Cylinders and Thin Spherical Shells **Due Date: 31st May 2024**

Answer **ALL** questions but you will be advised on the due date which questions to attempt in class.

1. A water main 80cm diameter contains water at a pressure head of 100m. If the weight of water is 1000kg/m^3, find the thickness of the material required for the water main, given that the maximum permissible stress 200x10^6kg/cm^2.

2. A pipe of 120cm diameter is to carry water under pressure of 20kg/cm^2. The longitudinal stress and circumferential stress is not to exceed 300kg/cm^2 and 400kg/cm^2 respectively. Determine suitable thickness of the pipe if the efficiencies of longitudinal and circumferential joints are 60% and 70% respectively.

3. A cylindrical shell 3m long, 1m in diameter, and thickness of the metal of 10mm is subjected to an internal pressure of 15kg/cm^2. Taking E=2x10^6kg/$cm^2$and Poisson's ratio = 0.3, calculate,
    a. The change in dimensions of the shell and
    b. The maximum intensity of shear stress induced.

4. Calculate the increase in volume enclosed by a boiler shell 2.4m long and 1m in diameter when it is subjected to an internal pressure of 16kg/cm^2. The wall thickness is such that the maximum tensile stress in the shell is 215kg/cm^2, under this pressure. Take E=2x10^6kg/cm^2 and Poisson's ratio = 0.28.

5. A cylindrical shell is 1.5m diameter and 4m long. It is subjected to 30kg/cm^2 internal pressure. If the maximum principal stress is not to exceed 1500kg/cm^2,

    a. Find the thickness of the shell. Assume E = 2 x 10^6 kg/cm^2 and Poisson's ratio 0.25.
    b. Find the change in diameter, length and volume of the shell.

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