TORSION OF CIRCULAR SHAFTS

THIN CYLINDERS

UNIT-V

1. A cylinder has an internal diameter of 230 mm, has walls 5 mm thick and is 1 m long. It is found to change in internal volume by 12×10^{-6} m3 when filled with a liquid at a pressure p. If Young's Modulus = 200 GPa and Poisson's Ratio = 0.25, and assuming rigid end plates, determine: The values of hoop and longitudinal stresses;

b) The necessary change in pressure p to produce a further increase in internal volume of 15 %. The liquid may be assumed incompressible.

2. Design a suitable diameter for a circular shaft required to transmit 90 kW at 180 rpm. The shear stress in the shaft is not to exceed 70 MPa and the maximum torque exceeds the mean by 40%. Also find the angle of twist in a length of 2 metres. Take Modulus of rigidity = 90 GPa.

3) Compare the weights of equal lengths of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both the shafts is same and inside diameter is 2/3 of outside diameter in case of hollow shaft.

4. A hollow shaft is to transmit 400 KW power at 120 rpm. if the shear stress in not to exceed 60 N/mm2 and internal dia. is 0.65 of the external dia. Find internal and external diameters assuming that the maximum torque is 1.5 times the mean?

5. A hollow shaft having an internal diameter 50% of its external diameter transmits 600 kW of power a 200 rpm. Determine the external diameter of the shaft if the shear stress is not to exceed 65 MPa and the twist in the length of 3 m shaft should not exceed 1.5 degrees. Take modulus of rigidity = 100 GPa.

6. A cylindrical vessel is 1.5 m diameter and 4 m long is closed at ends by rigid plates. It is subjected to an internal pressure of 3 MPa. If the maximum principal stress is not to exceed 150 MPa, find the thickness of the shell. Also find the changes in diameter, length and volume of the shell. Take Young's modulus =200 GPa and Poisson's ratio = 0.25.

7. A hollow shaft of 600 mm. external dia. and 400 mm internal dia. is transmitting a power of 6000 KW at 160 rpm. Find the shear stresses at the outer and inner surfaces of the shaft. Draw the shear stress distribution for the wall of the shaft. Find the twist over a length of 4 m. of the shaft. Take E = 80 Gpa.

8. A shell of 4 m. long, 1 m. diameter is subjected to an internal pressure of 1 $N/mm^{2.}$ If the thickness of shell is 10 mm; find the circumferential and longitudinal stresses. Find also the maximum shear stress and changes in the dimensions of the shell. Take E = 200 Gpa. and poisson's ratio = 0.3.