1. A thin-walled spherical pressure vessel has an inner diameter of 2 m and a thickness of 10 mm. Its diameter is increased by 1 mm when the vessel is pressurized. Determine the pressure causing this deformation, and find the maximum in-plane shear stress and the absolute maximum shear stress at a point on the outer surface of the vessel. The material is steel, for which Young’s modulus $E = 200 \text{ GPa}$ and Poisson’s ratio $\nu = 0.3$. 

2. For the beam loaded as shown in Fig. 2, determine the angle of rotation at $B$ for member $AB$ and the deflection at $B$, and draw the shear and moment diagrams. The flexural rigidity for member $AB$ and $BC$ is $EI$. 

![Fig. 2](image-url)
3. The uniform circular shaft of diameter $d$ shown in Fig. 3 is attached to rigid wall at end $A$ and is welded to a rigid flange at end $C$. The holes in the flange were supposed to align with holes tapped in the wall plate. But due to geometric misfit a uniformly distributed torque $t_0$ must be applied over the segment BC to rotate end $C$ through an angle $\phi$ to perfectly align the holes in the flange with those in the wall plate. When bolts are inserted at $C$ and securely tightened, the initial distributed torque $t_0$ is removed. Determine the final maximum residual shear stress. (25%)

![Fig. 3](image_url)

4. The right-angle elastic frame ABC is supported by a roller at end $A$, a hinge at its corner $B$, and an elastic spring at end $C$ as shown in Fig. 4. The legs $AB$ and $BC$ have the same flexural rigidity $EI$. The elastic spring has a spring constant $k = 2EI/L^3$ and is initially free of stretch. Determine the reactions at $A$ and $B$ if a moment $M_o$ is applied at end $A$. (25%)

![Fig. 4](image_url)