

Numerical problems (on elasticity)

Q.1) A bar of 30 mm diameter is subjected to pull of 60 kN.

The measured extension on gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm.

Calculate.

(a) Young's modulus (b) Poisson's ratio

(c) Bulk modulus.

Q.2 Determine the value of Young's modulus and Poisson's ratio of a metallic bar of length 30 cm, breadth 4 cm and depth 4 cm when the bar is subjected to an axial compressive load of 400 kN. The decrease in length is given as 0.075 cm and increase in breadth is 0.003 cm.

Ans:

$$\text{Young's modulus (Y)} = \frac{\text{Tensile stress / compressive stress}}{\text{Longitudinal strain}}$$

$$\text{Poisson's ratio (}\mu\text{)} = \frac{\text{Lateral strain}}{\text{Longitudinal strain}}$$

$$\rightarrow \text{Longitudinal strain} = \frac{\text{stress}}{Y}$$

$$\text{Longitudinal strain} = \frac{0.075}{30} = 0.0025$$

$$\text{Lateral strain} = \frac{0.003}{4} = 0.00075$$