



**Tutorials     Elasticity**  
(Term: Aug to Dec 2019)

1. A copper wire of length 1.5m and diameter 0.8mm, hanging vertically is loaded with 3.5 kg at the bottom. Calculate the elongation and lateral compression. Young's modulus and Poisson's ratio of copper are  $11.5 \times 10^{10} \text{ N/m}^2$  and 0.32 respectively.
2. A rod with rectangular cross section (1cm $\times$ 2cm) and 1m long hanged vertically is loaded with 5kg at its bottom. Calculate the elongation if the young's modulus of the material is  $20 \times 10^{10} \text{ N/m}^2$ .
3. A 1.5m long steel wire is stretched by a 15N. Calculate the elongation if radius of wire is 0.35mm and the young's modulus is  $18 \times 10^{10} \text{ N/m}^2$ .
4. Calculate Poisson's ratio for silver. Its Young's modulus and bulk modulus are  $7.25 \times 10^{10}$  and  $11 \times 10^{10}$  respectively.
5. Poisson's ratio of a material is 0.28. A uniform rod of it suffers longitudinal strain  $3 \times 10^{-3}$ . Calculate the percentage change in its volume.
6. What couple must be applied to a wire of length 0.5m and diameter 0.8mm in order to twist one end through  $6^\circ$  when the other end is fixed? The rigidity modulus is  $5 \times 10^{10} \text{ N/m}^2$ .
7. An iron wire of length 1m and radius 0.5 mm elongates by 0.32 mm when stretched by a force of 49 N, and twists through 0.4 radian when equal and opposite torques of  $3 \times 10^{-3} \text{ N-m}$  are applied to its ends. Calculate the elastic constants of iron.
8. The free end of a wire of length 32cm and diameter 0.56mm passes through the center of a rectangular plate of length 20cm and breadth 12 cm. The rigidity modulus of the material of the wire is  $8 \times 10^{10} \text{ N/m}^2$ . If the time period for torsional oscillations is 8s, calculate the couple per unit twist and the mass of the rectangular plate.
9. The free end of a wire of length 28cm and diameter 0.35mm passes through the center of a circular plate of diameter 16cm. The rigidity modulus of the material of the wire is  $7 \times 10^{10} \text{ N/m}^2$ . If the time for 10 torsional oscillations is 40s, calculate the couple per unit twist and the mass of the plate.
10. Calculate the young's modulus of material of a single cantilever of length, breadth and thickness 30cm, 2cm and 1mm respectively if it undergoes a deflection of 5mm at a point 25cm from its free end when 60gm is hanged at the free end.



11. A uniform rigid rod of length 0.8m is clamped horizontally at one end. A weight of 0.6kg is attached to the free end. Calculate the depression of a point 0.6m from the clamped end. The diameter of the rod is 2cm. Young's modulus of the material is  $11 \times 10^{10} \text{ N/m}^2$ .
12. Calculate the weight at the end of a single cantilever of length 65 cm, breadth 2 cm and thickness 1 mm such that the arc at the middle of the beam has a radius of curvature of 0.8 m. (Given  $Y = 20 \times 10^{10} \text{ N/m}^2$ )
13. A cantilever of length 0.9m has a depression of 15mm at its free end. Calculate the depression at a distance of 0.5m from the fixed end.
14. A cantilever undergoes a deflection of 9mm under a certain load. What would be the deflection for the same load if the length and breadth are doubled and thickness is tripled?