1. The system consists of three identical rigid bars pinned together and stabilized by the springs of contant k. A moment M is applied to the central bar as shown in figure 1. Find the critical value of M which marks the borderline of elastic stability.

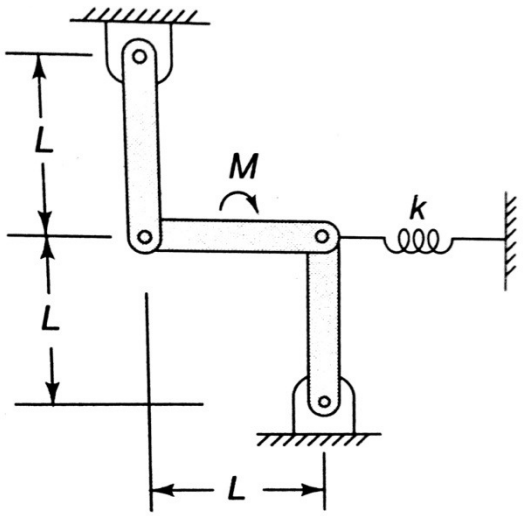

Figure 1

$$M = \frac{kL^2}{2}$$

2. Find the critical elastic compressive load for a uniform flexible beam which is hinged at both ends

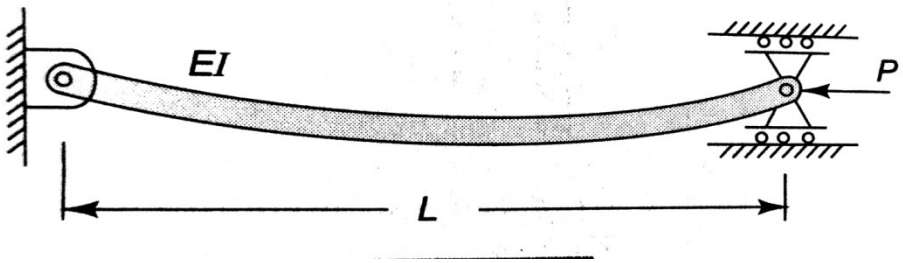

Figure 2

$$P_{Cr} = \frac{\pi^2 EI}{L^2}$$

3. A 1020 HR steel beam of square cross section, having side '2a' is to be used as a cantilever column. The length of the column is to be 2m. What should be the cross sectional dimension be so that the load which could cause yielding is 50 kN. σ_Y = 315 MPa.

   2a = 12.6 mm

4. A 1020 HR steel beam of square cross section, having side '2a' is to be used as a cantilever column. The length of the column is to be 2m. What should be the cross sectional dimension be so that the load which could cause buckling is 50 kN. E = 200 GPa.

   2a = 47 mm

5. Find the corresponding critical load P due to buckling when B moves sideways and the strut is a 25 mm diameter 2024 TS aluminium rod. E = 75 GPa. Find the critical load

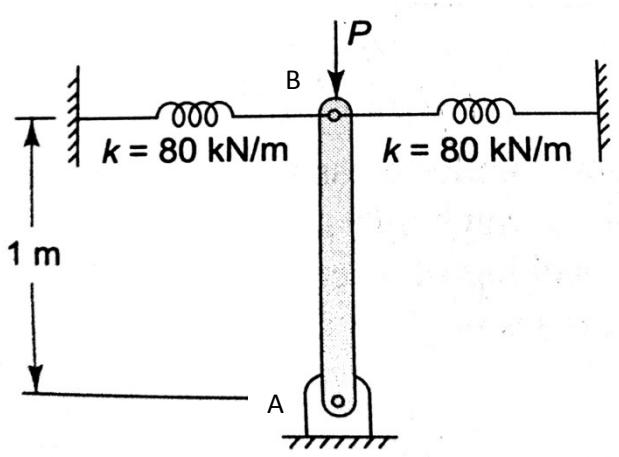

Figure 3

P_{Cr} = 160 kN

6. In Figure 3 find the corresponding critical load P due to buckling when B does not move sideways and AB acts like a hinged column and the strut is a 25 mm diameter 2024 TS aluminium rod. E = 75 GPa. Find the critical load.

   P_{Cr} = 14.1 kN

7. Find the deflection at C du to the load P in terms of length L and bending modulus EI of the uniform beam AC.

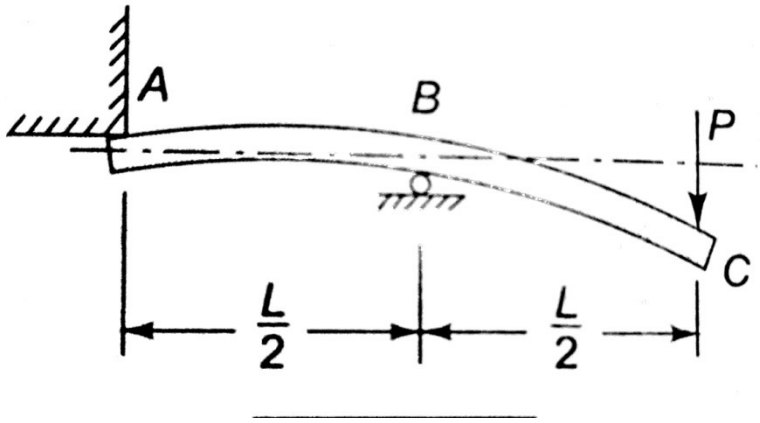

Figure 4

$$y = \frac{PL^3}{12EI}$$

8. An elastic wire of radius r has the form of a quarter circle of radius R. Obtain the deflection in the direction of the load P, taking into account axial loading only.

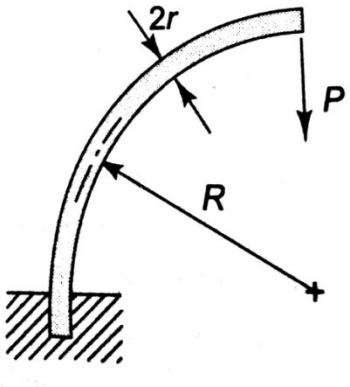

Figure 5

$$\delta_a = \frac{PR}{4r^2E}$$

9. Obtain the deflection in the direction of the load P, taking into account bending only.

$$\delta_b = \frac{PR^3}{r^4E}$$

10. What is the ratio of the axial contribution to the bending contribution.

$$\frac{\delta_a}{\delta_b} = \frac{r^2}{4R^2}$$