SNS COLLEGE OF TECHNOLOGY

16ME207- STRENGTH OF MATERIALS

UNIT II - TORSION AND SPRINGS

Application to close-coiled helical springs

Application to close-coiled helical springs

The coils are closely wound to each other, and lie on the same axis of the helix. The turns of this spring lie at 90 degrees to the axis of the helix. These springs are used for heavy duty applications such as carburettors, garage door assemblies, vies-grip pillars, etc.

Problem

1. A closely coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80 MN/m2.

Solution :-

Load to be carried, $W = 500N$

Mean Coil diameter, $D = 10d$ (wire diameter)

Shear Stress, $\tau = 80 MN/m^2$.

Diameters, D and d.

Using the relation, $\tau = \frac{16WR}{\pi d^3}$, we have

$$80 \times 10^6 = \frac{16 \times 500 \times 5d}{\pi d^3}$$

$$d^2 = \frac{16 \times 500 \times 5}{80 \times 10^6 \times \pi} = 1.591 \times 10^{-4} m^2.$$

$d = 0.0126m$ (or) $12.6 mm$.

$D = 10d = 10 \times 12.6 = 126 mm$.

$\boxed{D = 126 mm.}$

Problem

1. A (a) Draw neat illustrative sketches to bring about the difference between a helical coil tension spring and helical coil compression spring.

(b) A helical coil spring is made of round steel wire 6.35 mm in diameter. The mean radius of helix is 31.75 mm, number of complete turns, 12; the spring is close-coiled. If C = 84.36 GN/m2, find:

(i) The pull required to extend the spring by 25.4 mm, and

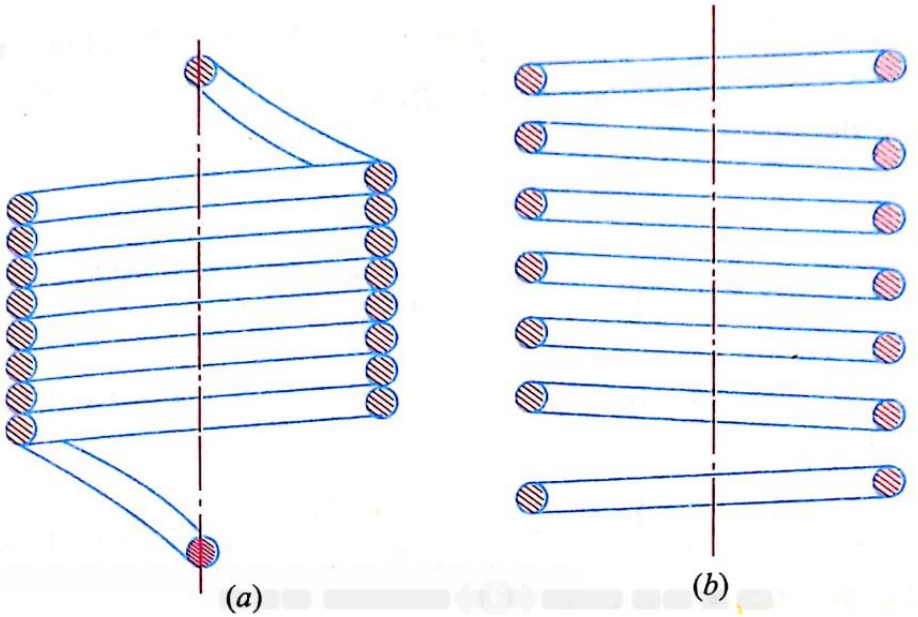
(ii) The stress in the wire.

Solution :-

a) The helical coil springs consist of a rod or wire wound in the form of helix. Figure (a, b) clearly indicates the difference between. The helix coil tension and compression springs.

Problem

It may be noted that in case of a helical tension spring it is not imperative to provide spacing between coils because helix angle is small while in case of helical compression spring, the helix angle being comparitively more, spacing is provided between the coils.



Problem

b) Radius of the coil, $R = 31.75mm = 0.03175m$.

Diameter of the wire, $d = 6.35mm = 0.00635m$.

Number of coils, $n = 12$.

Deflection of the spring, $= 25.4mm = 0.0254m$.

(i) Pull required to extend the spring, W :-

Using the relation,

$$\delta = \frac{64WR^3n}{Cd^4}, \text{ we have.}$$

$$0.0254 = \frac{64W \times (0.03175)^3 \times 12}{84.36 \times 10^9 \times (0.00635)^4}$$

$$W = \frac{0.0254 \times 84.36 \times 10^9 \times (0.00635)^4}{64 \times (0.03175)^3 \times 12}$$

$$\boxed{W = 141.7N}$$

(ii) Shear stress in the wire, τ :-

Using the relation,

$$\tau = \frac{16WR}{\pi d^3}, \text{ We have.}$$

$$\tau = \frac{16 \times 141.7 \times 0.03175}{\pi \times (0.00635)^3}$$

$$\tau = 89.5 \times 10^6 \ N/m^2.$$

$$\boxed{\tau = 89.5 \ MN/m^2.}$$