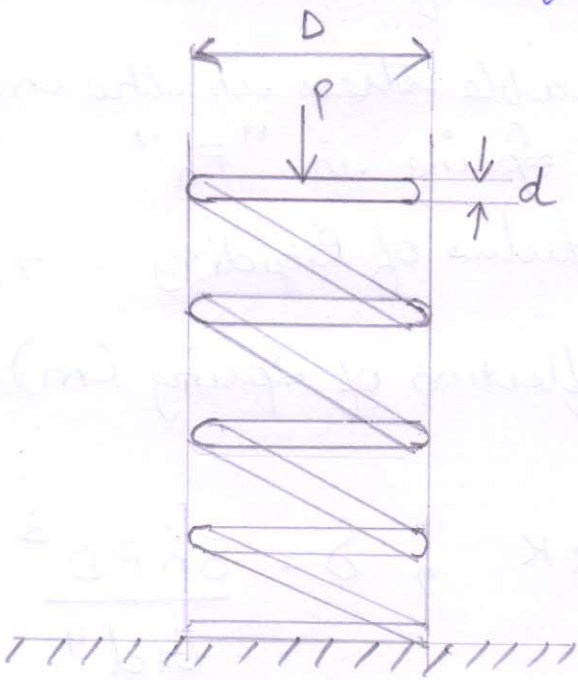
Design of Coil Spring

A coil Spring is a mechanical device which is typically used to store energy and subsequently release it, to absorb, or to maintain a force between the contact surfaces.



Mean diameter
= D - d

Coil spring are mainly subjected to torsion. The failure of the spring occurs due to shear. The stress varies uniformly from a maximum of the surface to zero at the center of circular cross section

The average stress is equal to $\frac{2}{3}$th maximum

A coil spring is diagramatically shown, there at both ends there is a dead coil smaller in size to the main spring and ground plate, so that it can rest on the spring seat properly

Let,

$P \rightarrow$ Axial load on the Spring (N)

$d \rightarrow$ diameter of the Spring (m)

$D \rightarrow$ Mean coil diameter (m)

$n \rightarrow$ number of active coil

τ (or) $f_s \rightarrow$ Allowable stress in the material of the Spring in "Pa"

$G \rightarrow$ Modulus of Rigidity $= 73575 \times 10^6$ Pa

$\delta \rightarrow$ deflection of Spring (m)

$$\tau = \frac{8PD}{\pi d^3} \times K \quad , \quad \delta = \frac{8nPD^3}{Gd^4}$$

$C \rightarrow$ Spring Index $= \frac{D}{d}$

$$K = 1 + \frac{1}{2C} \quad \text{[Neglecting effect of curvature]}$$

$$K = \frac{4C-1}{4C-4} + \frac{0.165}{C} \quad \text{[Considering the effect of curvature]}$$

Stiffness of Spring or Spring rate

$$\frac{W}{\delta} = \frac{Gd^4}{8D^3n} \text{ (or) } \frac{Gd}{8C^3n}.$$