Design of Machine Elements: Rutam s Rajhansa
B22ME055

Lab-7:

* Calculations:

(a) P = 500N, C = 6

Grade-2: $\sigma = 81.370 MPa$

$$\tau_{max} = 0.5 S_{ut}$$

$$\tau = \frac{8 K_s F D}{\pi d^3}, \quad K_s = 1 + \frac{0.5}{C} = 1 + \frac{0.5}{6} = 1.08$$

$$\frac{D}{d} = 6 = C \Rightarrow D = 6d$$

$$\therefore \tau = \frac{8 \times 1.08 \times 500 \times 6d}{\pi d^2 \times d} \leq \tau_{max} = 0.5 S_{ut}.$$

⇒ Now for different values of d we will try and calculate τ_{max} and τ_{all}. till we get the value of d such that the spring does not fail.

If we take

for d = 2.5mm $\tau_{allow} = 1278.2$

$\sigma_{yt} = 1660$

$\therefore \tau_{max}' = 830N$

$\tau_{all} > \tau_{max}$

$\therefore$ Fail

(2) Now: $d = 3.6$ → ~~$\tau_{all} = 638.9$~~

on calculating $\tau_{all} \rightarrow 640$

$\tau_{max} = 760.$

Now as $\boxed{\tau_{all} > \tau_{max}}$

→ Then result Thus we can consider above diameter.

$\therefore \boxed{d = 3.6}$ $\boxed{D = 6 \times 3.6 = 21.6}$

$P_{max} = 250$ and $P_{min} = 100$ $P_m = \frac{250+100}{2} = 175N$

$P_a = \frac{250-100}{2} = \boxed{75N}$ . .

$\tau_s = \frac{K_s 8 P_m D}{\pi d^3} = \frac{1.08 \times 8 \times 175 \times 6d}{\pi d^2 \times d}$

$d = 3.6$.

∴ on calculating $\boxed{\tau_S = 223.5}$ N/mm²

and $K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$ ⇒ $C = 6$ → $\boxed{K = 1.25}$.

Now $\frac{\tau_a}{\frac{S_{sy}}{FOS} - \tau_m} = \frac{0.5 S_{el}}{S_{sy} - 0.5 S_{el}}$ →

$S_{el}' = 0.21 S_{ut} = 0.21 \times 1510$
$= 317.1$ N/mm²

$S_{sy} = 0.42 S_{ut} = 0.42 \times 1510$
$= 634.2$ N/mm²

③ ∴ substituting.

we get F.O.S. as (1.2).

∴ as FOS > 1 and FOS < 1.5.

it is verified.

Solidworks calculations: (for turns)

$G = 81370$ $\quad \therefore k = \frac{F}{\delta} = \frac{500}{20} = (25)$.

$\delta = 20mm$

$F = 500N$. $\quad N = \frac{\delta G d^4}{8 D^3 K} =$

substituting we get $N = 6.7868$.

$\therefore \boxed{N = 7}$

$\therefore \boxed{\text{No. of turns} = 7.}$