Now
from table

$P = 200\,w = \frac{1}{4}\,hp$

$\tau = 1.5\ Nm$

rpm = 3000

Now we need 700 rpm (≈50km/h)

$VR = \frac{3000}{700} = 4.16$

Say $VR = 4$ then $n_{out} = (750\ rpm)$

from table $pd = 32$

$F = \frac{12}{pd} = \frac{12}{36} = 0.3$ inch

Now

$32 = \frac{N}{D}$ Say $N_p = 18$ — $\phi = 20°$

$D = \frac{18}{32} = 0.8$ $N_g = (4)(18)$

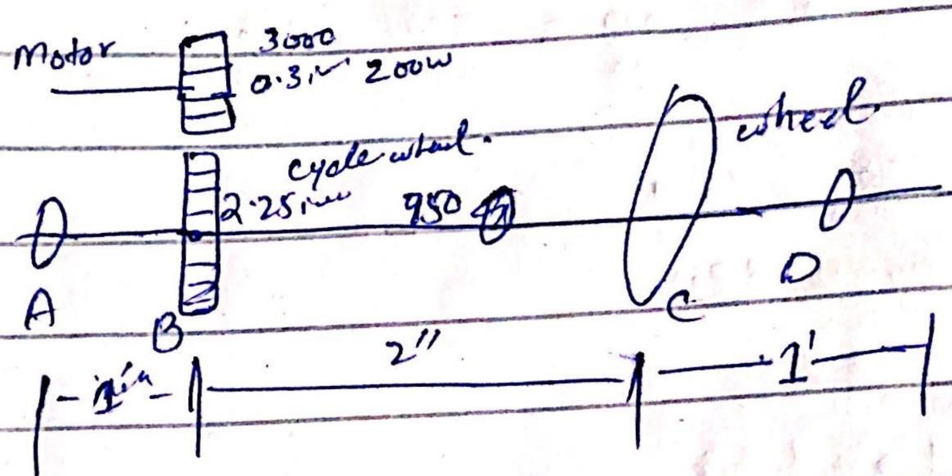
$\boxed{N_g = 72}$

$\boxed{D_p = 0.5\ inch}$

$\boxed{N_p = 18}$

$$P_g = \frac{N_G}{P_d} = \frac{72}{32} = 2.25 \text{ inches}$$

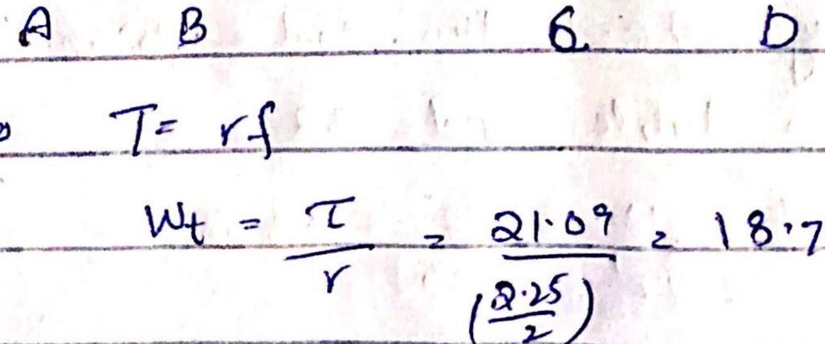
Now Shaft Design



$P = \tau \omega$

$$\tau = \frac{P}{\omega} = \frac{\cancel{200\,watt}\ 0.25\,hp \times 63057}{750} = 21.09\,N.$$

power profile



Now $T = rf$

$$W_t = \frac{\tau}{r} = \frac{21.09}{\left(\frac{2.25}{2}\right)} = 18.74\,N$$

$$W_r = 18.74 \times \tan(20^\circ) = 6.82\,N$$

3000

$n_p = \cancel{1400}\ rpm$

$n_g = 700\ rpm\ (\sim 80\ km/h)$

$V.R = \frac{\cancel{4}3000}{700} = \cancel{5.71}\ 4.16$.

Say 16

$\boxed{n_g = 687.5}$

Now

from table

$P = 200W = \frac{1}{4} hp$

$\tau = 1.5\ Nm$

$rpm = 3000$

Now we need 700 rpm ($\simeq 50 km/h$)

$VR = \frac{3000}{700} = 4.16$

Say $V.R = 4$ then $n_{out} = (750\ rpm)$ $r = 0.2m$

$\rightarrow (56.54\ km/h)$

from table $pd = 32$

$F = \frac{12}{pd} = \frac{12}{36} = 0.3$ inch

$\theta = 20°$

Now

$32 = \frac{N}{D}$ Say $N_p = 18$

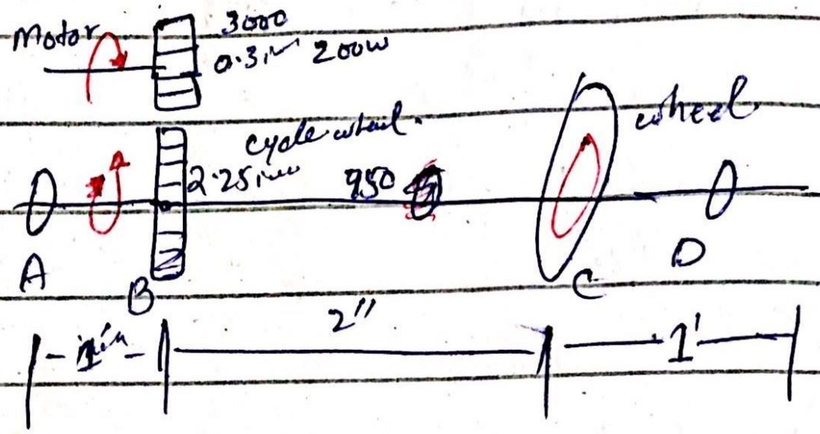
$\cancel{32}D = \frac{18}{32} = 0.5$ $N_q = (4)(18)$

$\boxed{N_q = 72}$

$\boxed{D = 0.5\ inch}$ $\boxed{N_p = 18}$

$P_g = \frac{N_G}{P_d} = \frac{72}{32} = 2.25$ inches

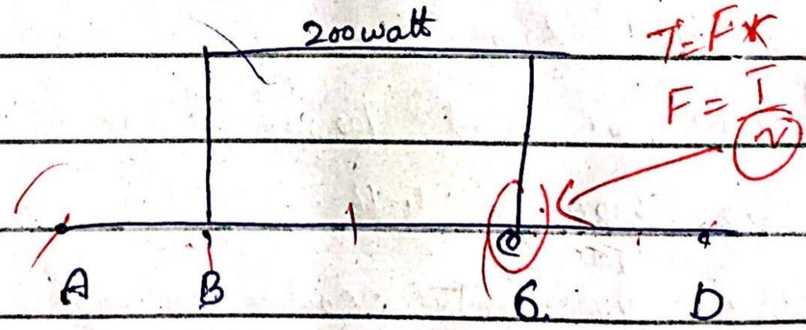
Now Shaft Design

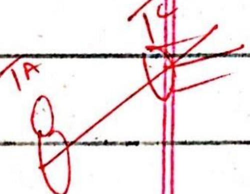


$P = \tau \omega$

$\tau = \frac{P}{\omega} = \frac{\cancel{200\,watt}\ 0.25\,hp \times 63057}{750} = 21.09\,Nm$

power profile





Now $T = rf$

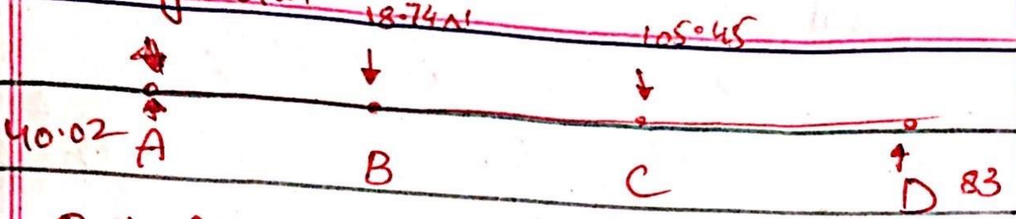
$W_{t_B} = \frac{\tau}{r} = \frac{21.09}{\left(\frac{2.25}{2}\right)} = 18.74\,N$

$W_{r_B} = 18.74 \times \tan(20^\circ) = 6.82\,N$

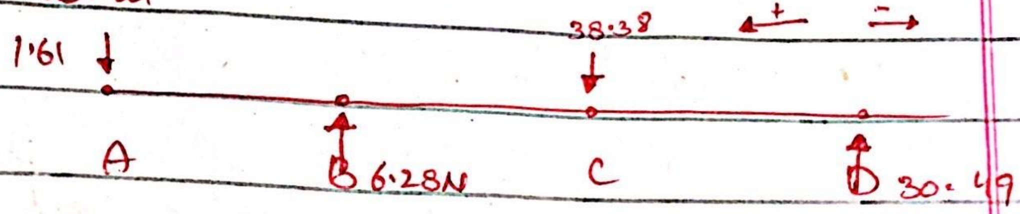
$P_c = \tau_c \omega_c$

$\tau_c = \frac{\cancel{21.09}\ 0.25}{750} \times 63057 = 177$

Tangential



Radial



T = 21.09

T = rf

$\frac{T}{r} = F$

$\frac{21.09}{0.2} = \boxed{W_{tc} = 105.45 N}$

$W_{rc} = 105.45 \times \tan(20^\circ) = 38.38 N$

Now $\Sigma F = 0$

$\Sigma M = 0$

ΣM_{At} Moment at A.

$0 = 1 \times 18.74 + 3(105.45) - 4(W_{td})$

$\frac{335}{4} = \boxed{W_{tD} = 83.7725 N}$

$\boxed{W_{rD} = 83.7725 N \tan 20^\circ = 30.49 N}$

$\Sigma F_t = 0$

$-A + 18.74 + 105.45 - \cancel{30}\ 83.7225$

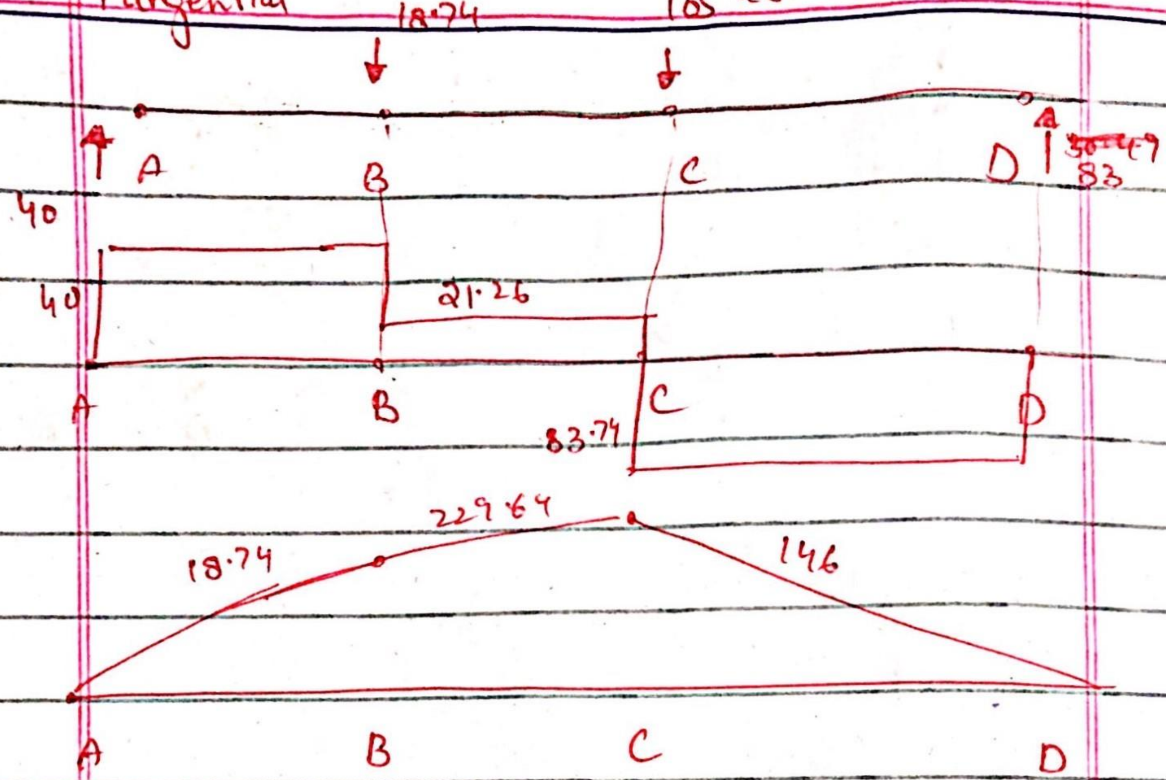
$\boxed{W_{tA} = 40.02}$

$\Sigma F_r = 0$

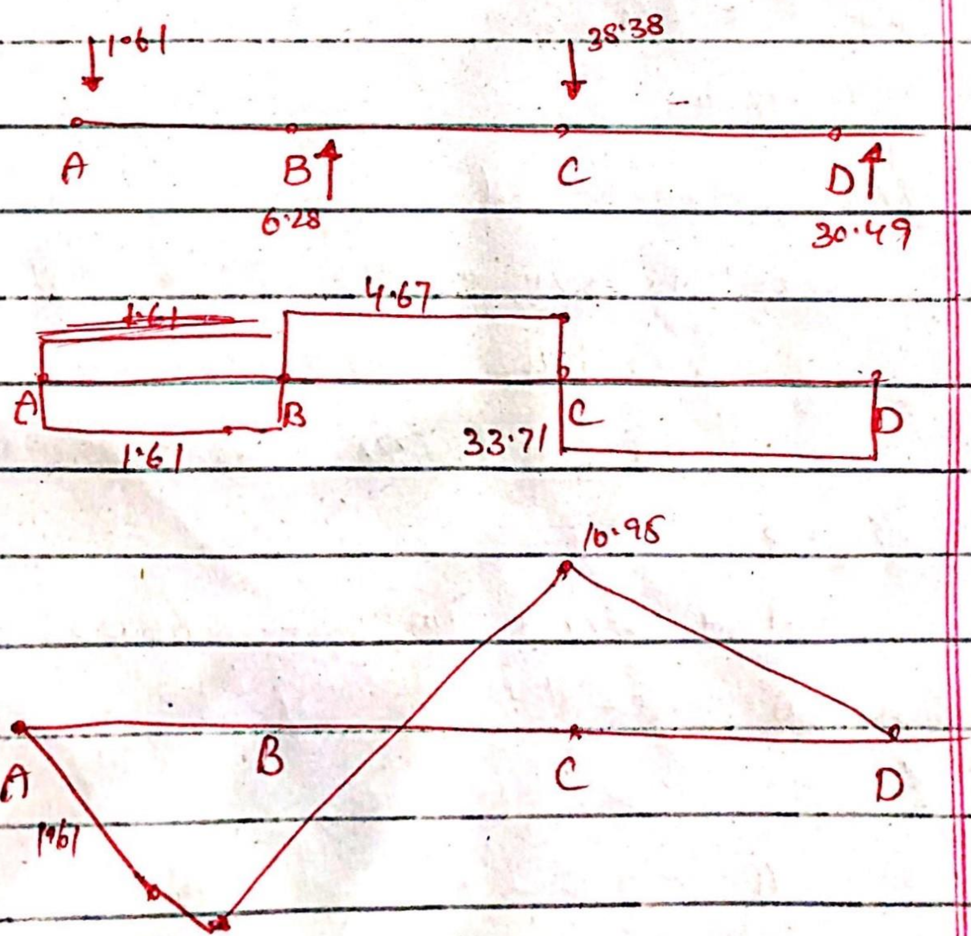
$A - 6.28 + 38.38 - 30.49$

$\boxed{W_{rA} = 1.61 N}$

Tangential



Radial



Now Stress Analysis of Gear

$P = 0.25\ hp$

$n_p = 3000$

$n_g = 750$

$N_p = 18$

$N_g = 72$

$\phi = 20°$

$V.R = 4$

Say $A_v = 6$

$K_v =$

$\boxed{J_p = 0.43}$

$\boxed{J_g = 0.334}$

$\boxed{K_v = 1.19}$

$\boxed{K_o = 1}$ $\boxed{K_s = 1}$ $\boxed{K_b = 1}$

$P_{des} = K_o \times P = 0.25\ hp$

$\boxed{C_{pf} = 0.9}$ open gearing

$\boxed{C_{ma} = 0.26}$

$\boxed{K_m = 2.16}$

$$S_t = \frac{W_t\ P_d}{F\ J} K_o K_s K_m K_b K_v$$

J

↳ if $K_b = 1.2$

$\boxed{\sigma_t = 16.8\ MPa}$

$$S_{tg} = \frac{(18.74)(32)}{(0.33)(0.334)} (1)(1)(2.16)(1)(1.19)$$

$S_{tg} = 13984.91\ Pa = 14\ MPa$

$$S_{tp} = \frac{(18.74)(32)}{(0.33)(0.334)} (1)(1)(2.16)(1)(1.19) = 10862.70\ Pa$$

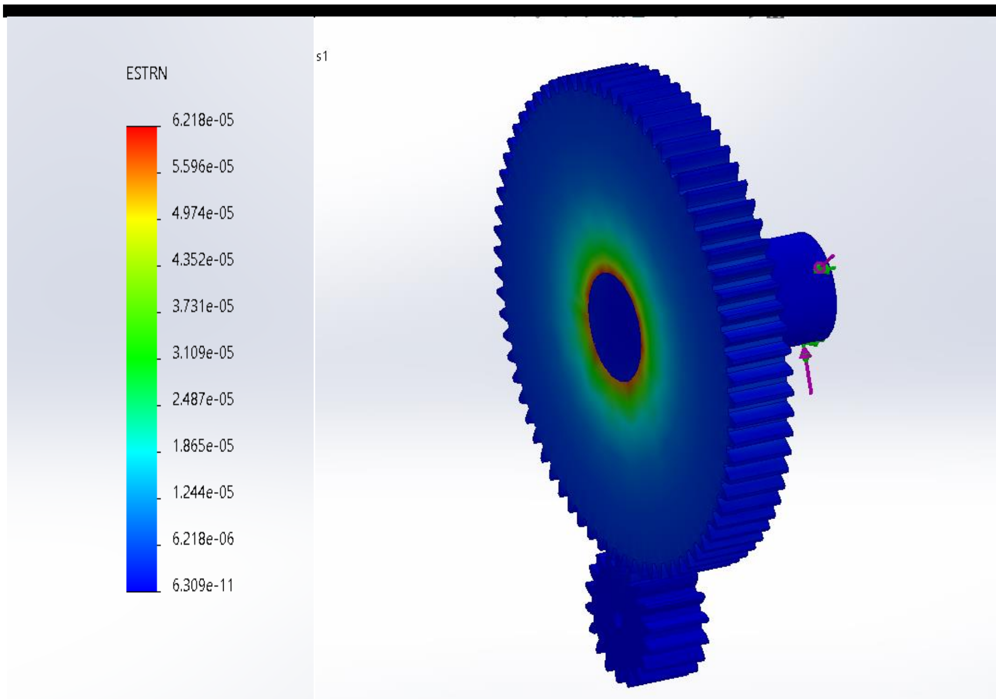
$10.8\ MPa$

For load cycle :

Now SAE 1018 have max

MPa = 441 can be used.

$$\sigma_t \frac{W_t\ P_d}{F J} = \frac{(18.74)(32)}{(0.33)(0.3)}$$


s1
ESTRN
6.218e-05
5.596e-05
4.974e-05
4.352e-05
3.731e-05
3.109e-05
2.487e-05
1.865e-05
1.244e-05
6.218e-06
6.309e-11