❖ After trying several pressure angles ϕ the one that fixed with the values given was 22.5 degree.

Data Given: External Gear, V_R = 3.7, C <= 100 mm.

From Interference theory and equation the teeth numbers will be found

$$(N_P)_{min} = \frac{2K}{(1+2VR)*\sin^2\phi}\left[VR + \sqrt{VR^2 + (2VR+1)Sin^2\phi}\right] \ldots\ldots (1)$$

Consider K=1, Full depth teeth.

$$(N_P)_{min} = \frac{2}{(1+2*3.7)*\sin^2 22.5}\left[3.7 + \sqrt{3.7^2 + (2*3.7+1)Sin^2 22.5}\right].$$

$(N_P) \geq 12.3$.

Take $\mathbf{N_P}$ = **13** teeth.

$$(N_g)_{max} = \frac{NP^2*Sin^2\phi - 4K^2}{4K - 2*NP*Sin^2\phi} \ldots\ldots\ldots (2)$$

$(N_g) \leq 107.852$.

Take $\mathbf{N_g}$ = **48** teeth.

$V_R = \frac{Ng}{Np} = \frac{48}{13} = 3.7$ as given.

$C = \frac{Np+Ng}{2} * m$, m: is the module . . . . . (3).

Assume C =90 mm,

From the previous equation

m = 2.95.

Take **m = 3** for standard value then by substituting m in the previous equation we have **C= 91.5 mm.**

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❖ For Pinion :

$m = \frac{dp}{Np}$ . . . . . (4)

$d_p = N_p * m = 13*3 =$ **39 mm**

$d_{bp} = d_p * \cos\Phi$ . . . . . (5)

$d_{bp} = 39 * \cos 22.5 =$ **36.03 mm**

Addendum radius $r_{ap} = r_p + m$ . . . . . (6)

$r_{ap} = 19.5 + 3 =$ **22.5 mm**

Dedendum radius $r_{dp} = r_p - 1.25m$ . . . . . (7)

$r_{dp} = 19.5 - 3.75 =$ **15.75 mm**

❖ For Gear :

From equation (4)

$d_g = 48 * 3 =$ **144 mm**

From equation (5)

$d_{bg} = 144 * \cos 22.5 =$ **133.04 mm**

From equation (6)

$r_{ag} = 72+3 =$ **75 mm**

From equation (7)

$R_{dg} = 72 - 3.75 =$ **68.25 mm**

❖ Contact Ratio Check

$C.R = \frac{Lab}{Pb}$ . . . . . (8)

$L_{ab} = \sqrt{rap^2 - rbp^2} + \sqrt{rag^2 - rbg^2} - C*\sin\phi$ . . . . . (9)

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$L_{ab} = \sqrt{22.5^2 - 18.015^2} + \sqrt{75^2 - 66.52^2} - 91.5*\text{Sin } 22.5$

$L_{ab} = \mathbf{13.10675}$.

$P_b = P_c * \text{Cos } \Phi$ . . . . . (10)

But $P_c = \pi*m$ . . . . . (11)

$P_c = \mathbf{3\pi}$

$P_b = 3\pi * \text{Cos } 22.5$

$P_b = \mathbf{8.707}$

$C.R = \frac{13.10675}{8.707} = \underline{\mathbf{1.50525}} > 1$

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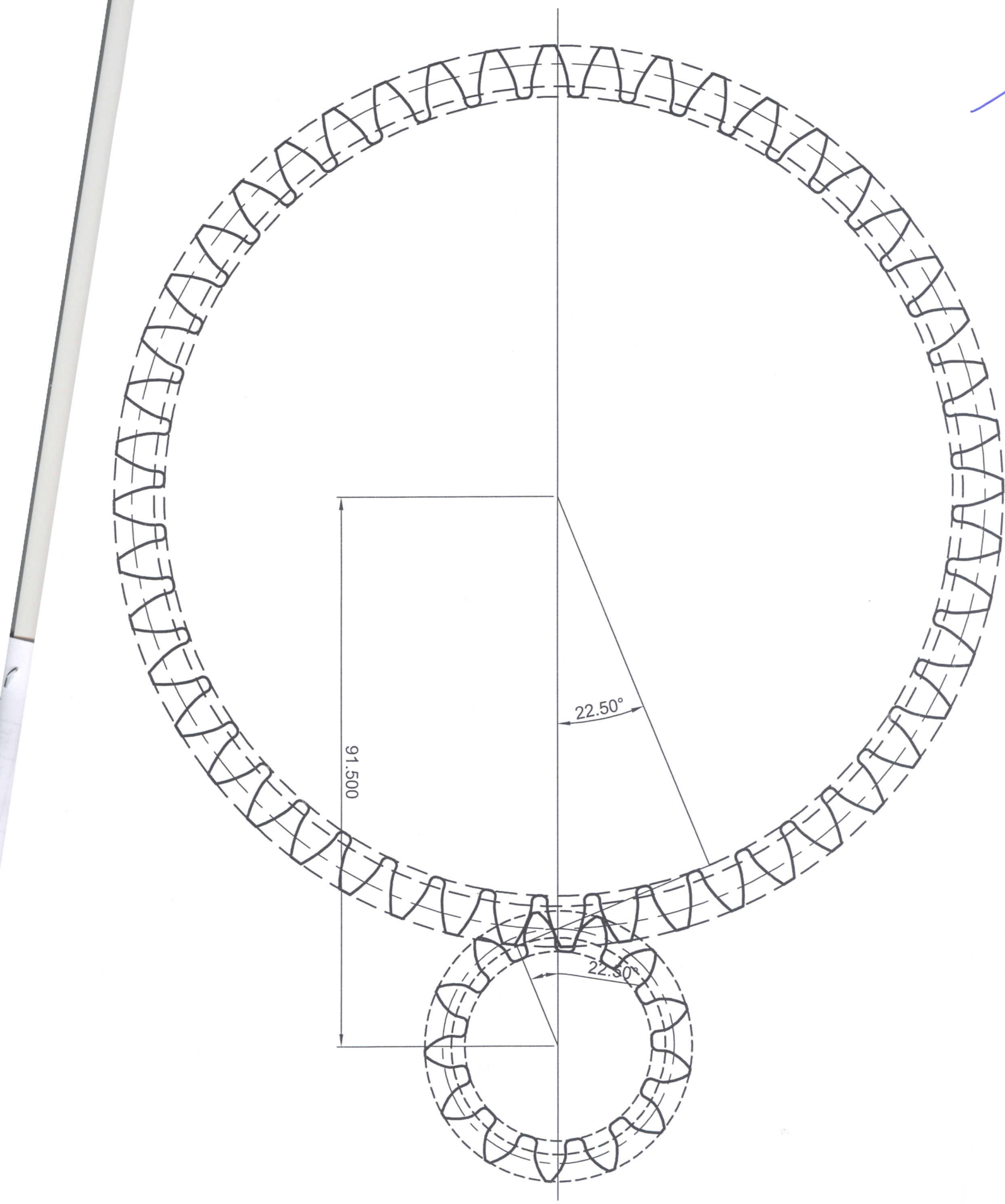

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