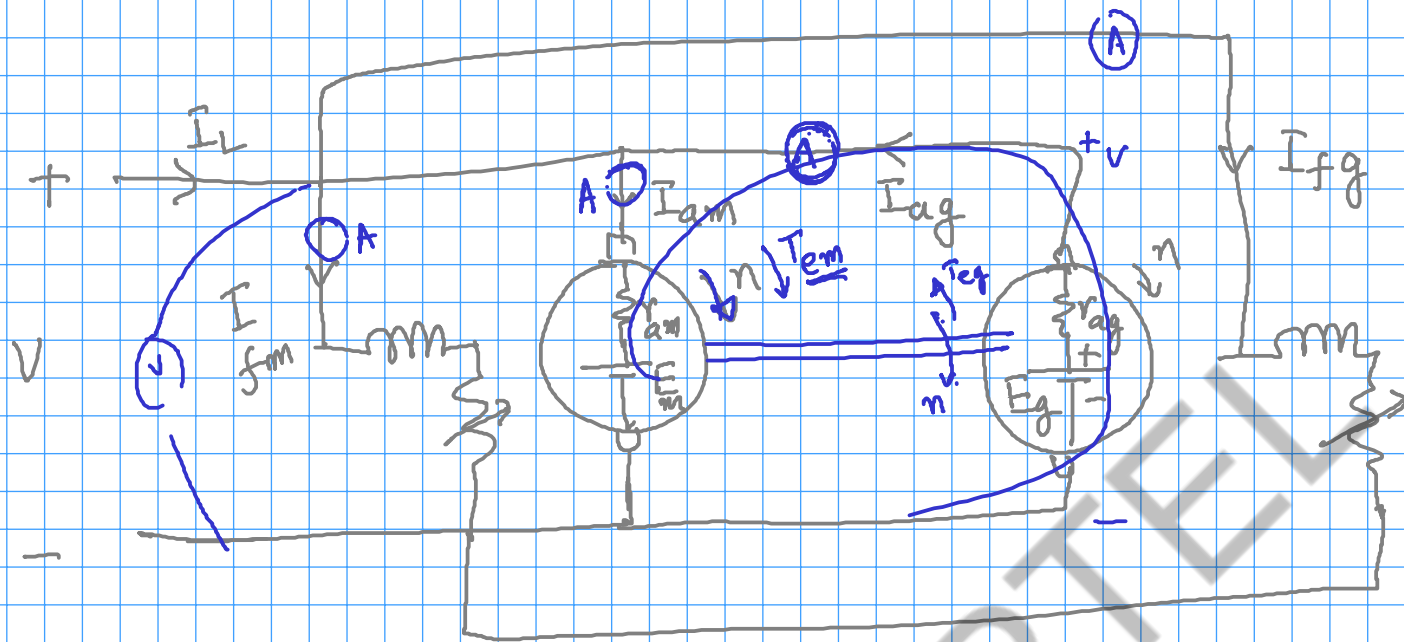




dec 91

Power drawn from the supply $= V I_L$

$$\text{Total rdt. loss} = W_0 = V I_L - V I_{fm} - V I_{fg} - I_{am}^2 r_{am} - I_{ag}^2 r_{ag}$$

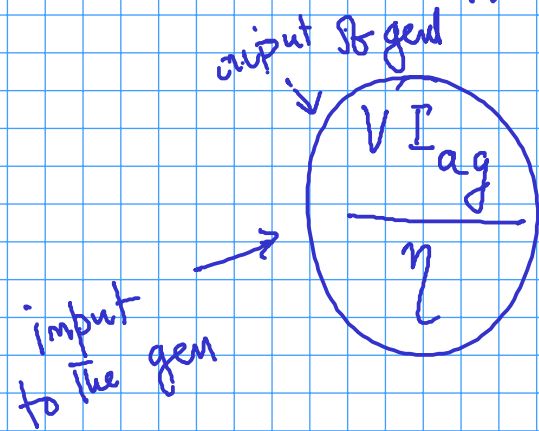
rdt. loss of each m/c $\approx W_0/2$

$$\eta_m = \frac{(V I_{fm} + V I_{am}) - V I_{fm} - I_{am}^2 r_{am} - \frac{W_0}{2}}{(V I_{fm} + V I_{am})}$$

$$\eta_g = \frac{V I_{ag}}{V I_{ag} + V I_{fg} + I_{ag}^2 r_{ag} + \frac{W_0}{2}}$$

output

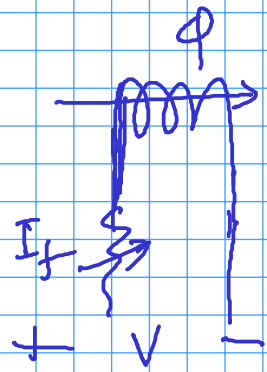
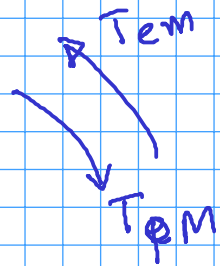
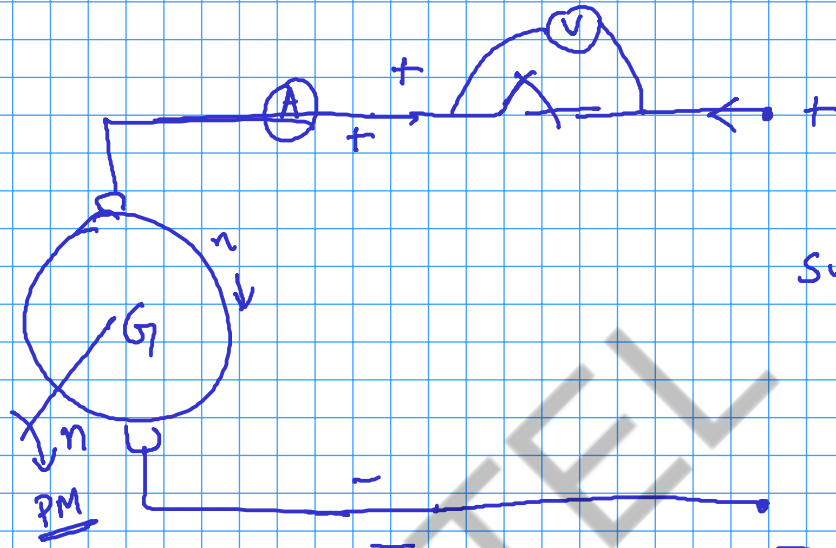
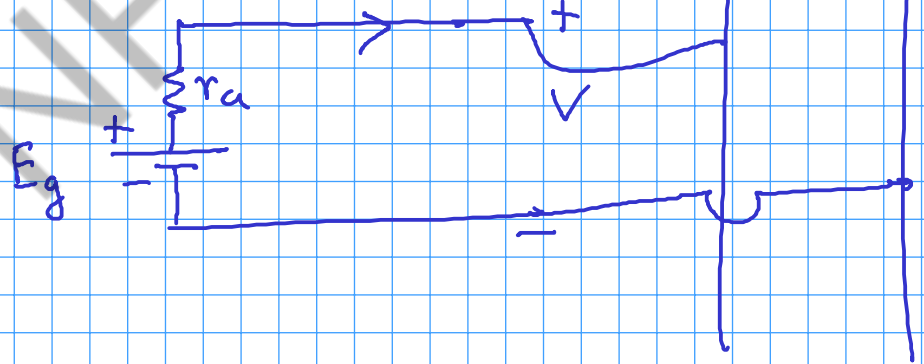
Let the efficiencies of both the m/c's are same $= \eta$



$$= V I_{am} \eta$$

$$\text{or } \eta^2 = \frac{I_{ag}}{I_{am}}$$

$$\text{or } \eta \approx \sqrt{\frac{I_{ag}}{I_{am}}}$$

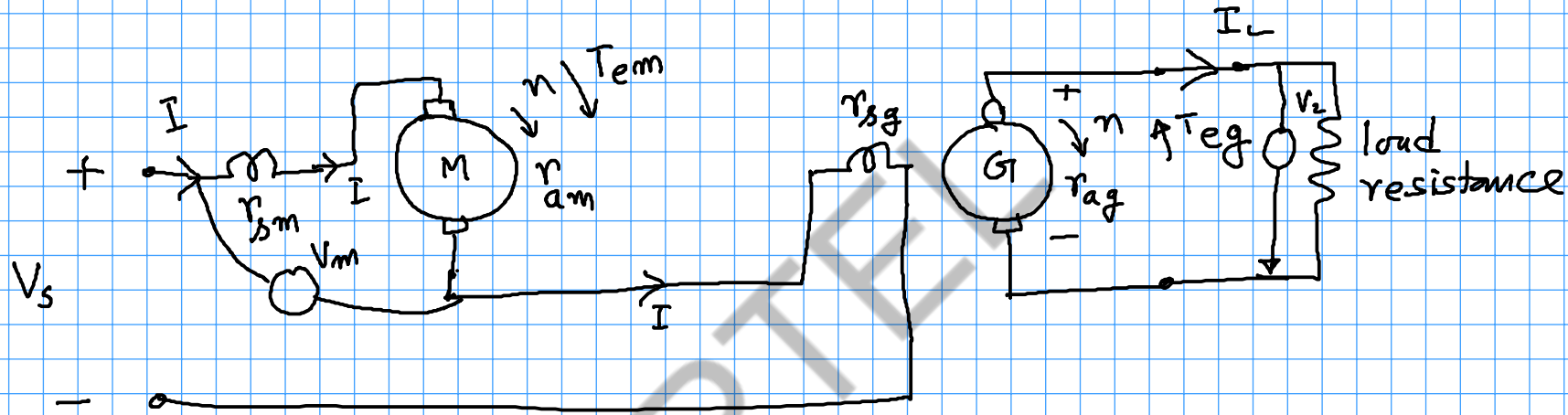


d.c supply

Field Test on Series motor

M & G
are mechanically
coupled

Sec-92



Power drawn from the supply = $V_s I$

Total ohmic loss = $(I^2 r_{sm} + I^2 r_{fm} + I^2 r_{sg} + I_L^2 r_{ag})$

Power delivered to the load = $V_L I_L$

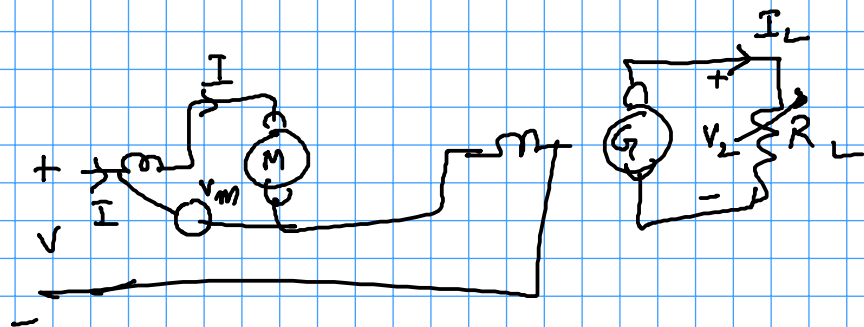
$\therefore V_s I - V_L I_L = \text{Total losses} = \text{Total ohmic loss} + W_o$

$\therefore W_o = \text{Total losses} - \text{Total ohmic losses}$

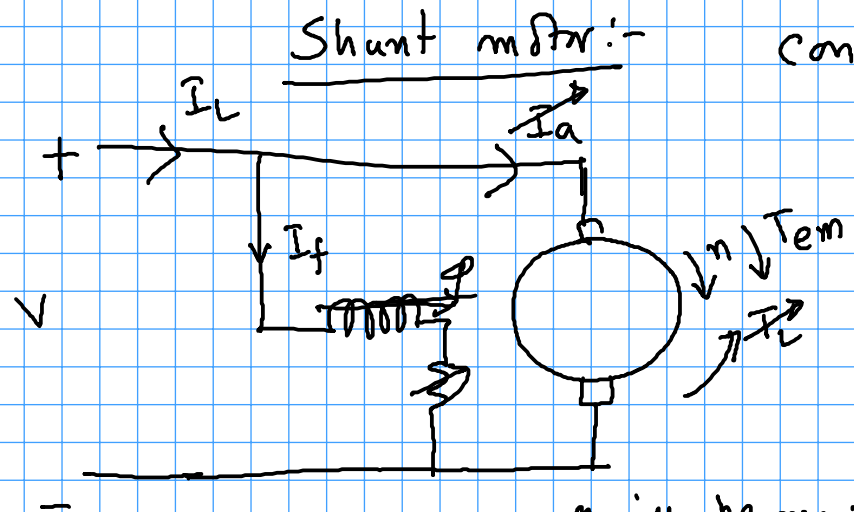
rotational loss of each m/c = $W_o/2$

rotational
loss
of both
the m/cs

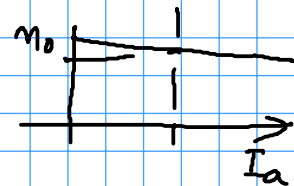
$$\eta_m = \frac{(V_m I - I^2 r_{sm} - I^2 r_{am} - \frac{w_0}{2})}{V_m I}$$



$$\eta_g = \frac{V_2 I_L}{V_2 I_L + (I_L^2 r_{ag} + I^2 r_{sg}) + \frac{w_0}{2}}$$



condition for max^m η (efficiency)



variable loss = Cu loss in armature
 $= I_a^2 r_a$

$$\eta_m = \frac{VI_L - VI_f - I_a^2 r_a - P_{rot}}{VI_L}$$

$I_a \gg I_f$
 $I_L \approx I_a$
 η will be max^m when fixed loss (P_{rot}) is equal to Armature Cu loss.

$$= \frac{VI_a - I_a^2 r_a - P_{rot}}{VI_L}$$

$$= \frac{VI_a}{VI_L} - \frac{I_a^2 r_a}{VI_L} - \frac{P_{rot}}{VI_L}$$

$$\therefore \frac{d\eta_m}{dI_a} = -\frac{r_a}{V} + \frac{P_{rot}}{V} \frac{1}{I_a^2} = 0$$

$$\therefore I_a^2 r_a = P_{rot}$$

$$\eta_m \approx$$

$$1 - \frac{I_a^2 r_a}{VI_a} - \frac{P_{rot}}{VI_a} = 1 - \frac{r_a}{V} I_a - \frac{P_{rot}}{VI_a}$$

coil span

$$\text{Coil span} = \frac{16}{4} = 4$$

coil no. 1 : 1-5'

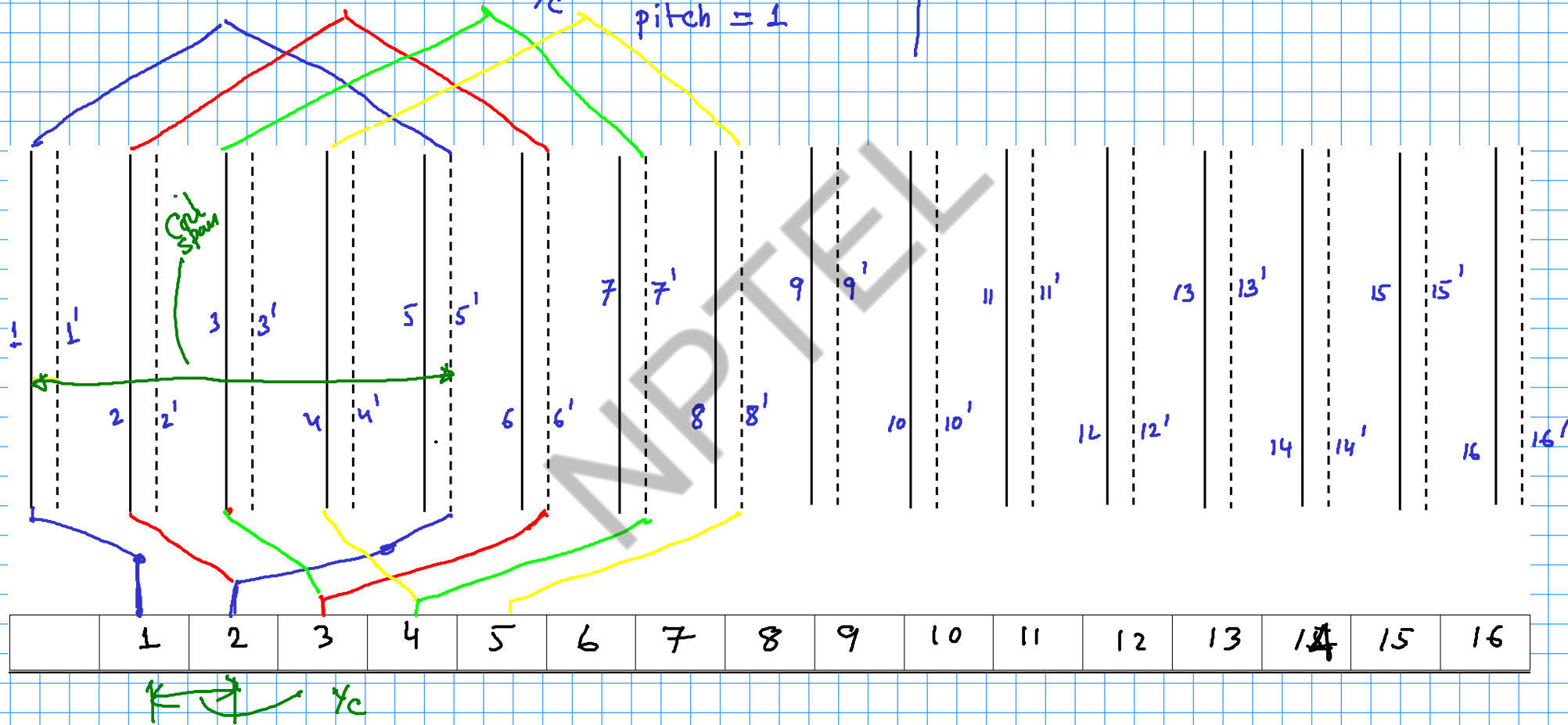
$\gamma_c = \text{commutator pitch} = 1$

double layer
wdg

$S = 16$
 $P = 4$
no. of

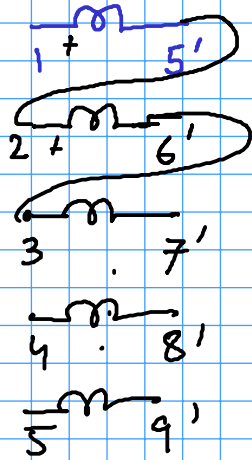
Dec-93

comm. segments = C
 $= S = 16$



⑥

$$S = 16$$



⑦

$$p = 4$$

$$\text{coil span} = 4$$

$$y_c = +1$$

winding table

segments on which ends of a coil are terminated

1 & 2

2 & 3

3 & 4

Separation between +ve & -ve brush in terms of commutator segments

$$= \frac{c}{p}$$

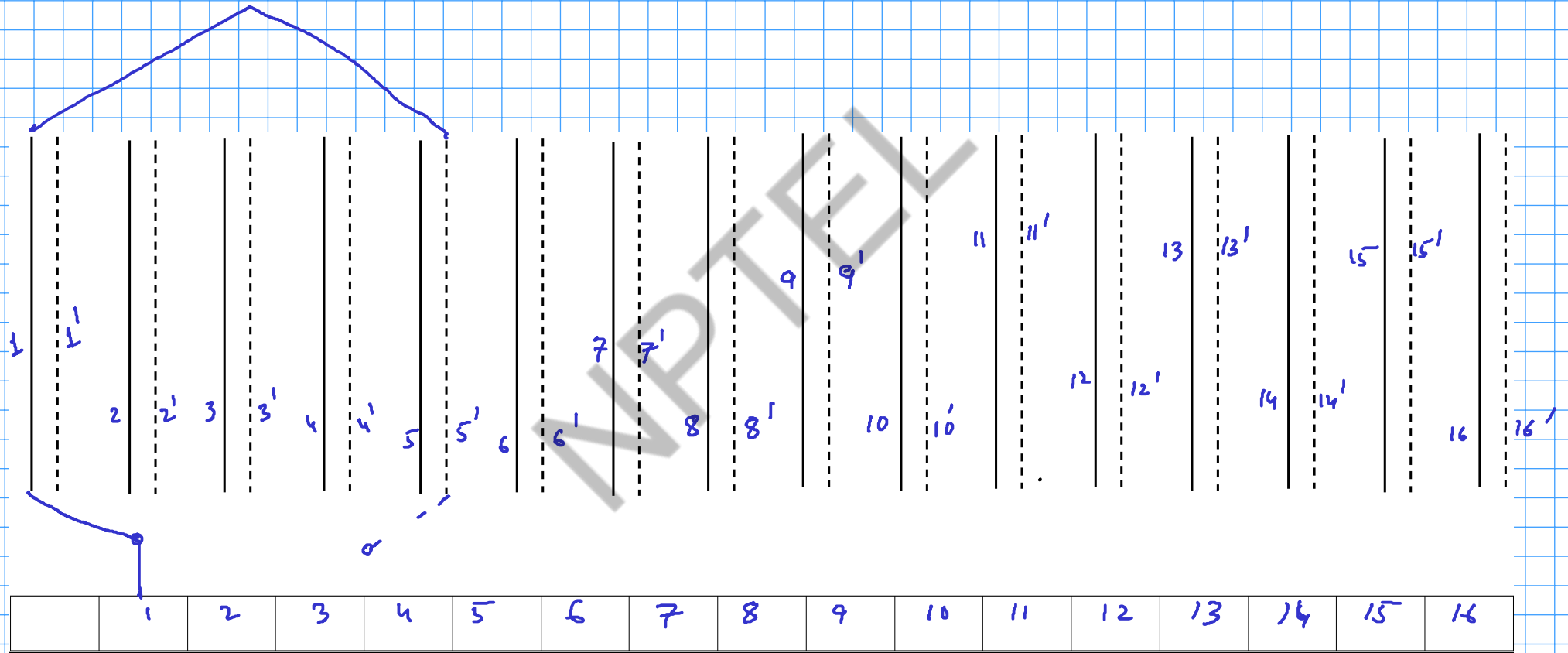
Pl. complete this table

$$S = 16$$

$$p = 4$$

$$\text{coil span} = \frac{16}{4} = 4$$

$$y_c = ?$$



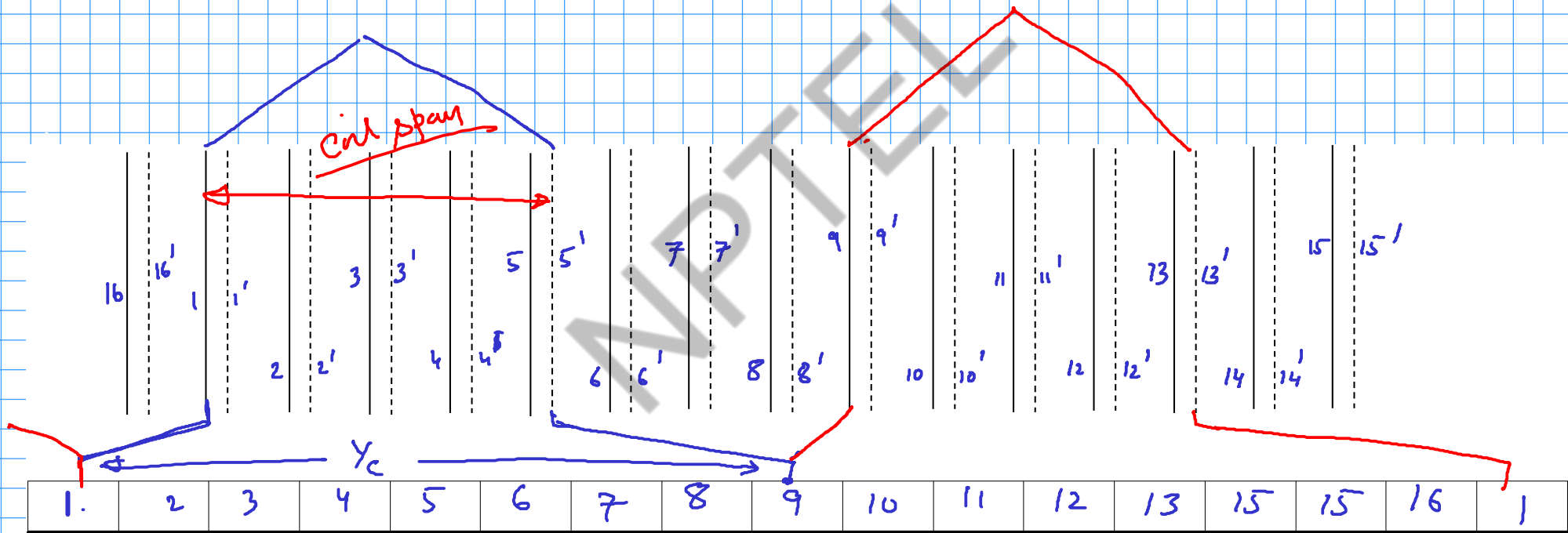
Wave winding

$$S = 16 \\ = C$$

$$p = 4$$

$$\frac{S}{p} = 4$$

$$Y_c = \frac{2C}{p} = \frac{2 \times 16}{4} \\ = 8$$



Year	Number of people in the workforce (millions)
1990	60
1995	60
2000	65
2005	75
2010	95

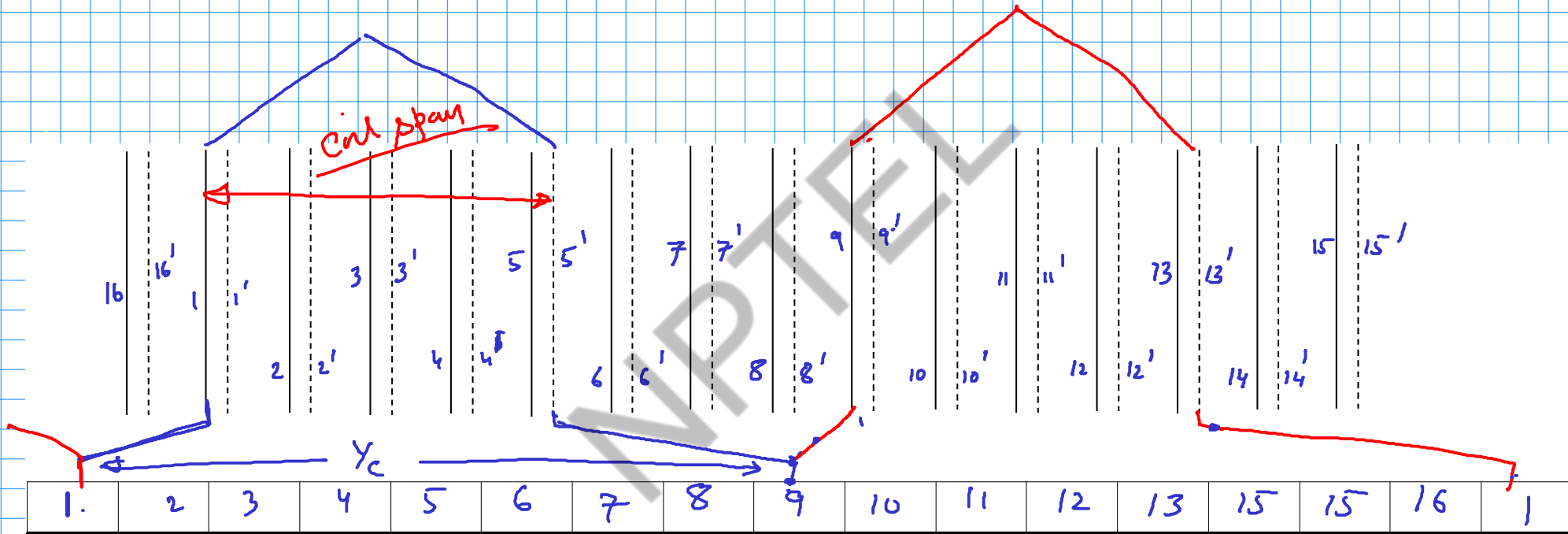
$$S = 16$$

$$p = 4$$

coil span = 4

$$y_c = \frac{2 \times 16}{4} = 8$$

Year	Number of people (millions)
1990	60
1995	58
2000	62
2005	61
2010	60



1 m 5'

Lap:- $Y_c = \pm 1$
 Crane wdg $Y_c = \frac{2(C \pm 1)}{P}$

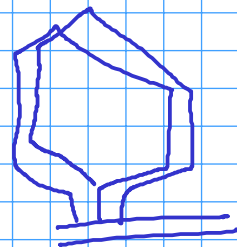
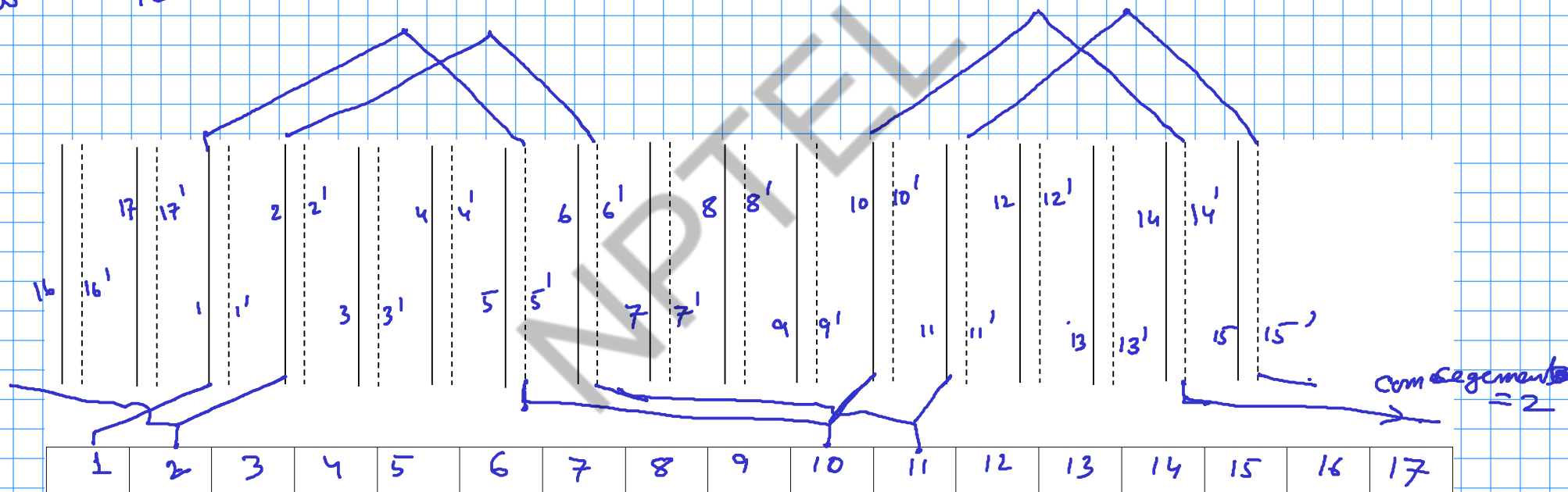
coil span = $\frac{17}{4} \approx 4$

$$Y_c = \frac{2(C \pm 1)}{P} = \frac{2(17 \pm 1)}{4} = 9 \sim$$

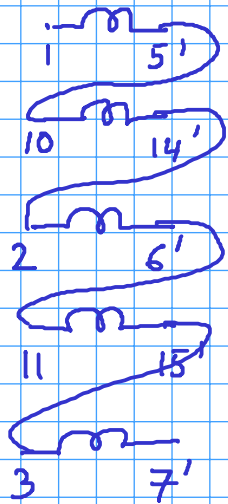
$$S = 17 = C$$

$$p = 4$$

$$Y_c =$$



Wave winding table



comm segments
where the ends of a coil terminated

1 & 10

10 & 2

2 & 11

11 & 3

3 & 12

I case of

Wave winding

no. of coils between any two
consecutive comm. segments.

$$= \left(\frac{P}{2} \right) \quad (\text{in this case } P=4, \text{ i.e., 2 coils})$$

separation

$$\text{+ve \& -ve brush} = \frac{C}{P}$$

How many coils are present between

+ve & -ve brush?

$$\frac{P}{2} \times \frac{C}{P} = \frac{C}{2}$$

$\therefore$ No. of // paths
in wave wdg = 2

$$S = 17 = C$$

$$p = 4$$

$$\text{coil span} = \frac{17}{4} \approx 4$$

$$Y_c = \frac{2(C+1)}{2} = 9$$

$$\frac{2ab}{P} \times 1 = 1 \times \frac{C}{P} = \frac{C}{P}$$

$$\frac{C}{2} \quad \frac{P-4}{2}$$