NAME = ABDUL - Haseeb

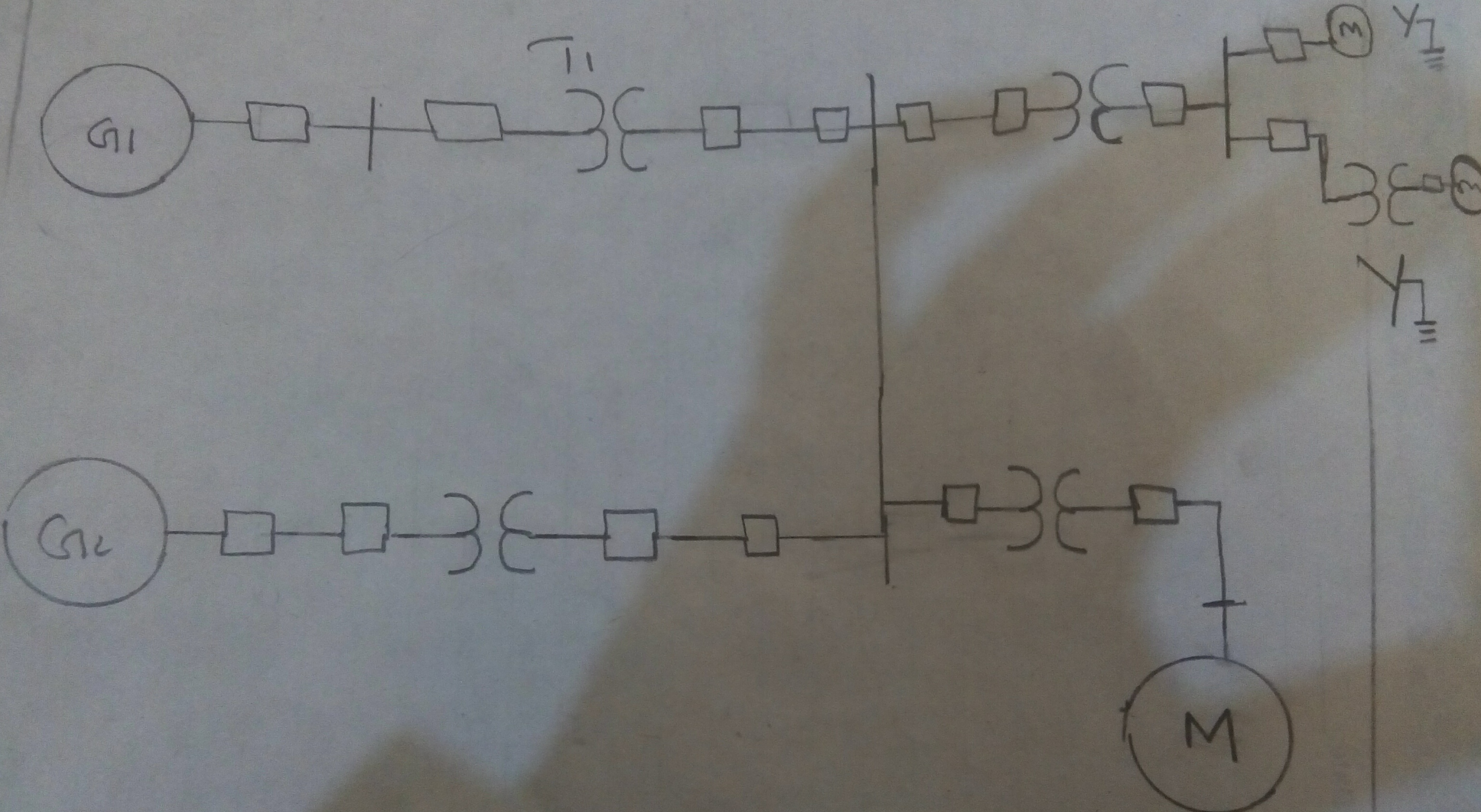
ID = 6988

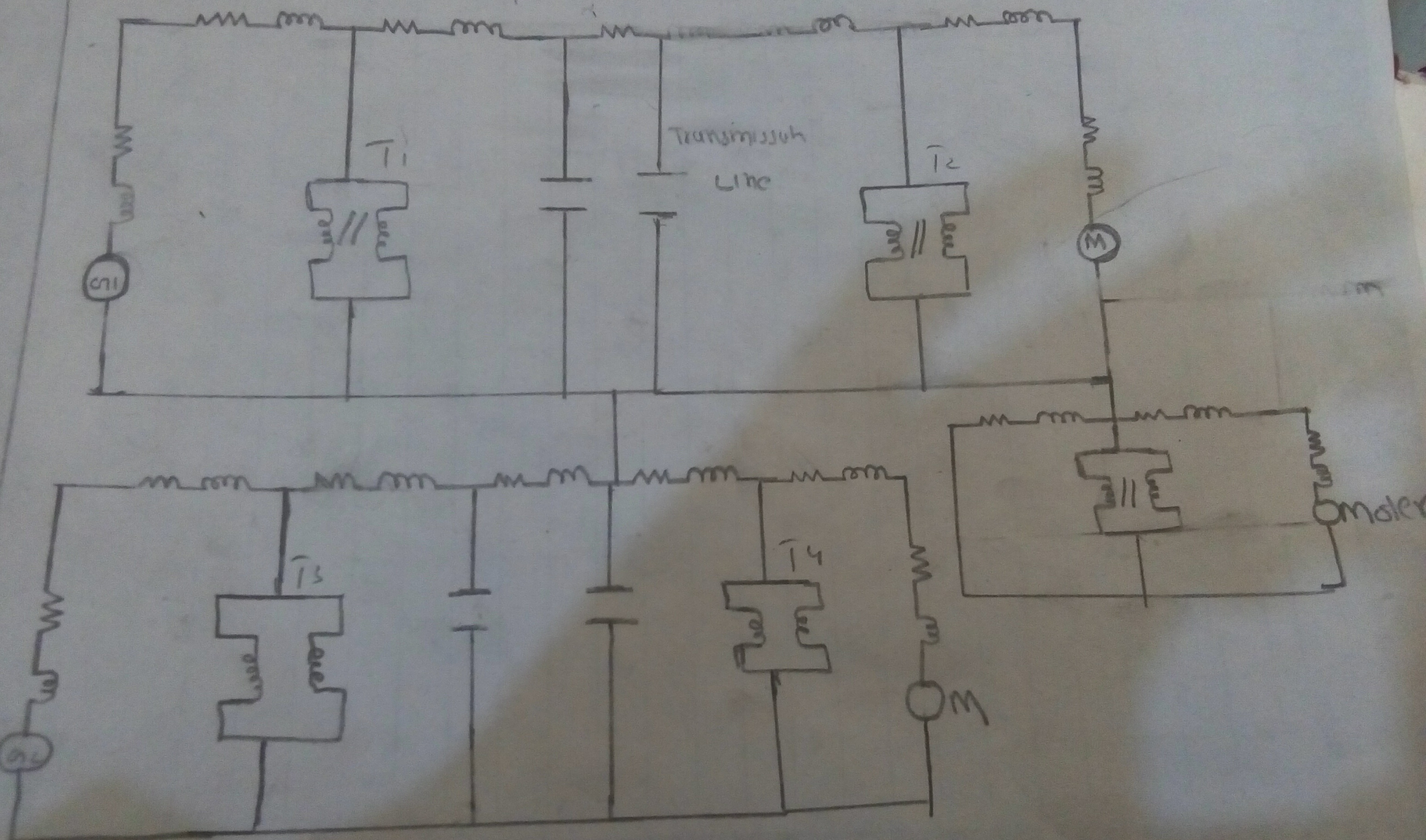
Subject = power - System Analysis

Submitted to = Engr- muhammad - Amir - Aman

Assiment No = 1

Q = 1 Single line Digram = Convert into Reactance & Impedance.




T1
Transmission
Line
T2
M
T3
T4
M
motor

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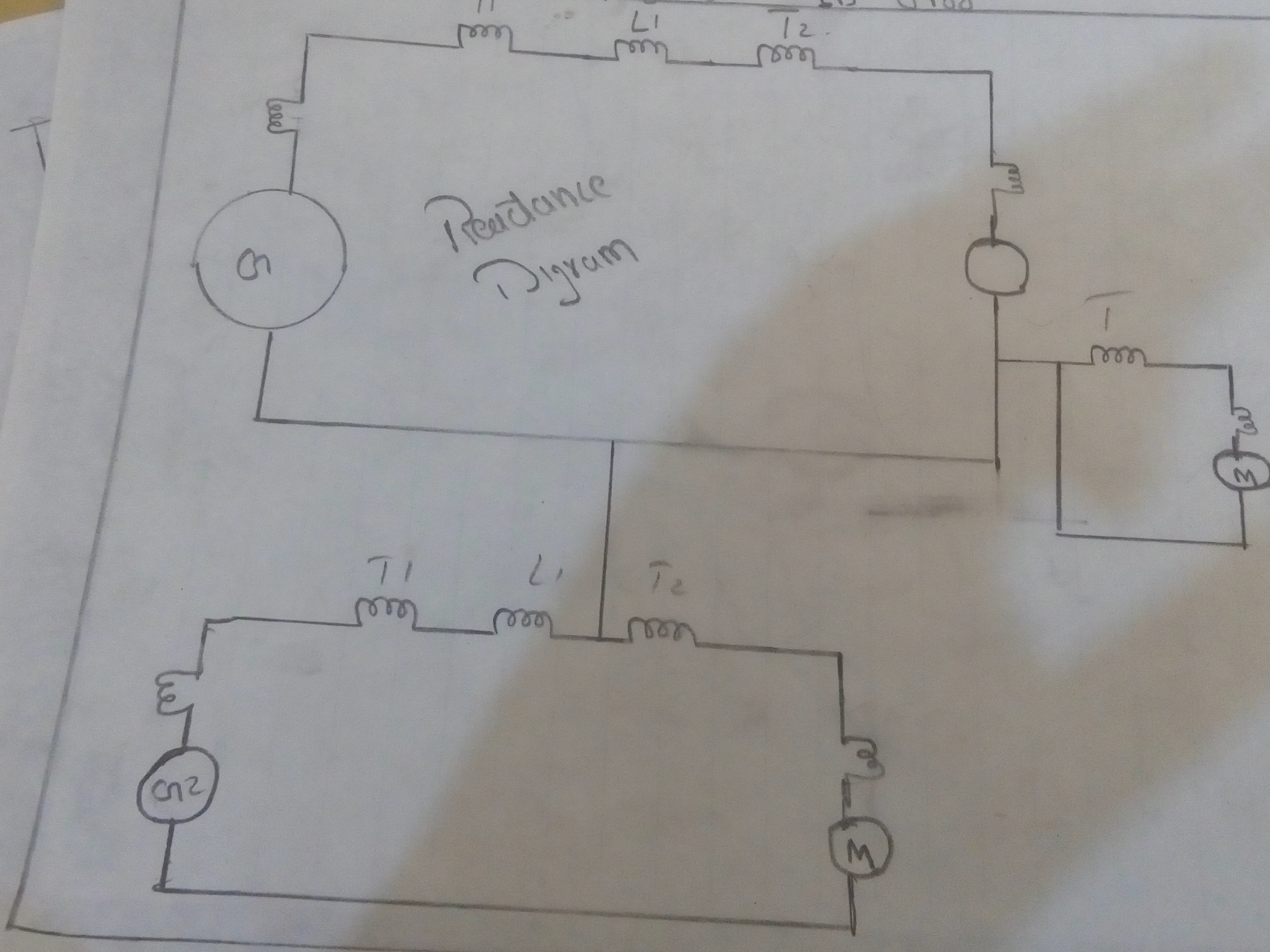


Q

Question Number = 2

A transformer is rated 20kV/220kV 300 MVA and has internal impedance of 6.4Ω seen from the low voltage side 22kV, 400MVA as base show Vpu, Spu and Zpu.

→ $V_{pu} = Z_{p.u} \times I_{p.u}$

$= 6.4 \times 350 = 2240$

~~Z~~ $S_{pu} = V \times I$

~~20×~~ 22×350

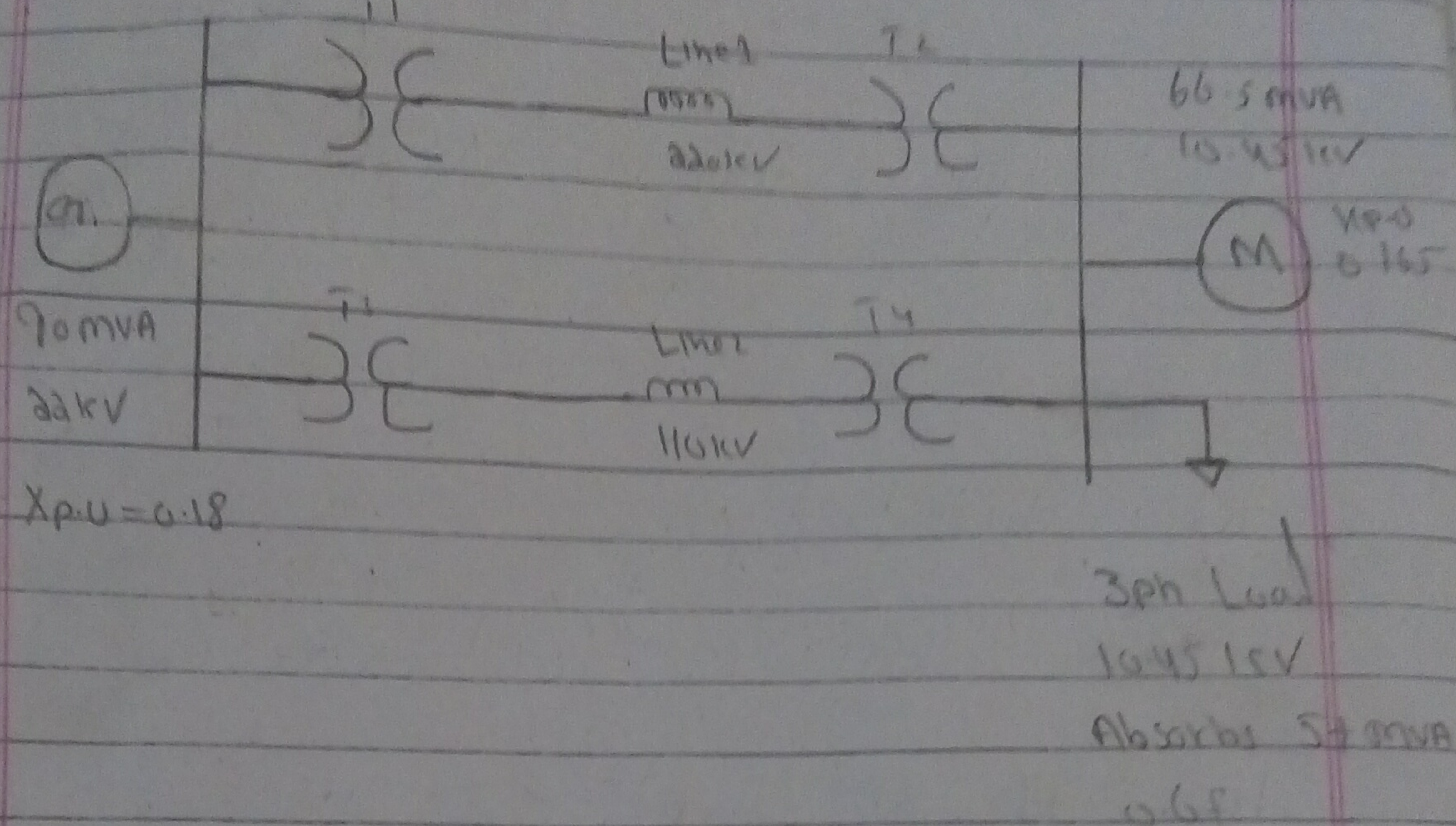
$S = 7700$

$Z_{p.u} = \frac{V^2_{base}}{S_{base}}$

$\frac{(22)^2}{7700}$

$\frac{484}{7700}$

0.0628



T_1 = 50 MVA, 22/220kV Xpu = 0.10

T_2 = 40 MVA 220/11kV Xp.u 0.06

T3 = 40 MVA 22/110kV Xpu = 0.064

T4 = 40 MVA ~~110~~ 110/11kV Xp.u = 0.08.

Line 1 48.4 ohm (total)

Line 2 65.43 ohm (total)

=> The equivalent impedance Digram of the above system.

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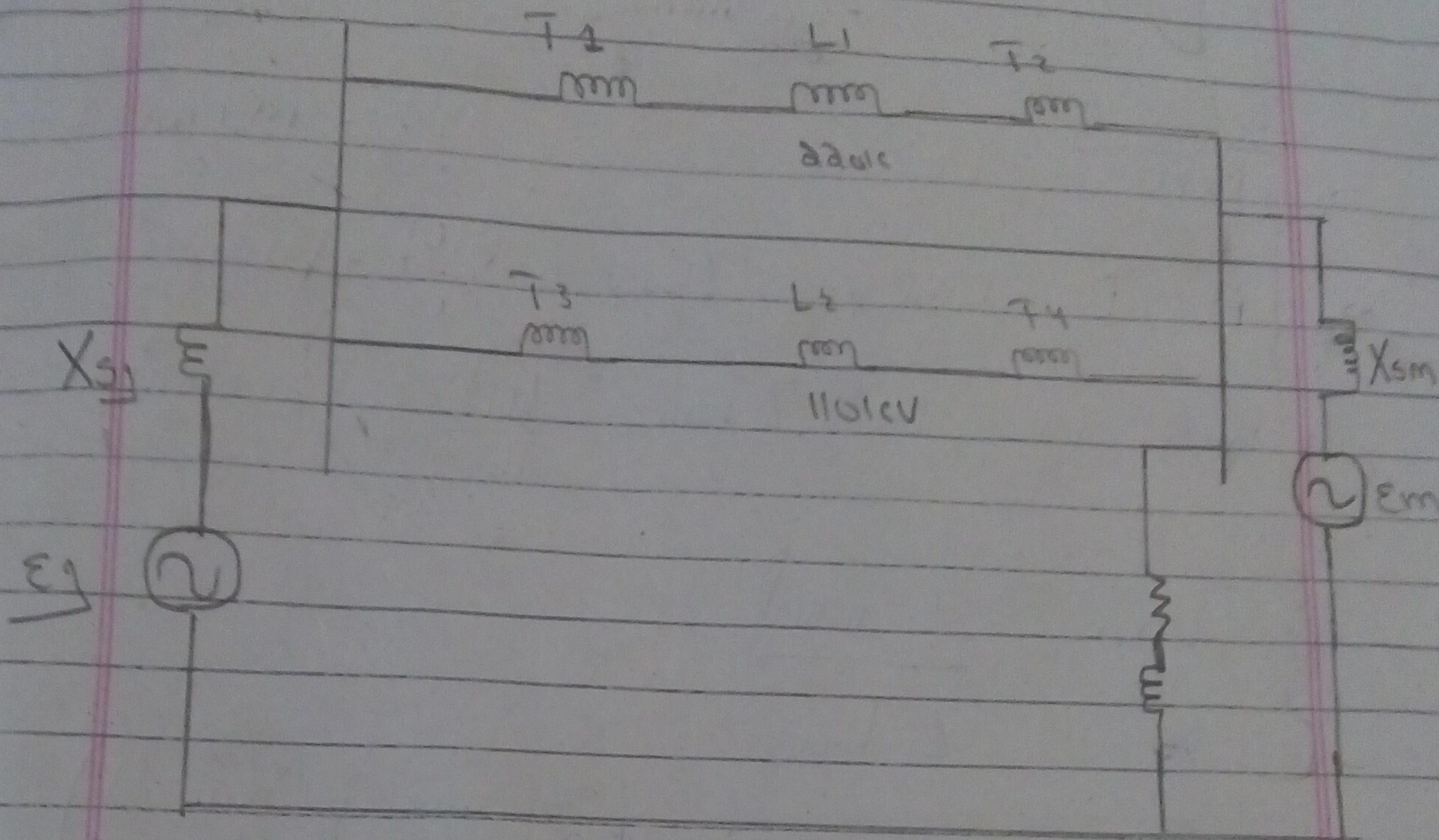
Impedance Digram



Assume a system Sbase of 100 MVA. This is random assumption and chosen to make a calculation easy when per unit impedance.

So, Sbase = 100 MVA

=> Calculation

$$Z_{base} = \frac{kV_{base}^2}{Z_{base}\ MVA}$$

=> For T-Line 1 $Z_{base} = \frac{(220)^2}{100} = 484\ ohm$

=> For T-Line 2 $Z_{base} = \frac{(110)^2}{100} = 121\ ohm$

For 3-phase Load $Z_{base} = \frac{(11)^2}{100} = 1.21\ ohm$

=> $$Z_{p.u} = \frac{Z_{actual}}{Z_{base}}$$

$$Z_{p.u.new} = Z_{p.u.old} \left(\frac{S_{base\ new}}{S_{base\ old}}\right)\left(\frac{V_{base\ old}}{V_{base\ new}}\right)^2$$

~~The Voltage ratio in equation~~

The ratio of the transformer Voltage rating on the primary side and secondary side to the system nominal Voltage on the same side

For T-Line 1 using $X_{L1\,p.u} = \frac{48.4}{484}$ = ~~0.100~~

0.1 p.u

For T-Line 2, using (2) $X_{L2\,p.u}\ \frac{65.43}{121}$

0.5 p.u

for 3-phase Load.

Power factor $\cos^{-1}(0.6) = \angle 53.13$

Thus ~~S~~ $S_{3\phi}$ (Load) $= 57\angle 53.13$

~~Zad (Vrated / S*)~~

$$Z_{ad}\left(\frac{(V_{rated})^2}{S^*}\right) = \frac{10.45^2}{57\angle -53.13}$$

$\Rightarrow 1.1495 + j1.53267$ ohm

$$\frac{1.1495 + j1.5326}{1.21}$$

$0.95 + j1.2667$ pu

For generator the new per unit reactance equation

$$X_{sg} = 0.18\left(\frac{100}{90}\right)\left(\frac{22}{22}\right)^2$$

$$= 0.2 \text{ p.u}$$

For Transformer T_1: $X_{t1} = 0.1\left(\frac{100}{50}\right)\left(\frac{22}{22}\right)^2 = 0.2 \text{ pu}$

" " T_2: $X_{t2} = 0.06\left(\frac{100}{40}\right)\left(\frac{220}{220}\right)^2 =$

0.15 pu

~~" " T_3~~

" " T_3: $X_{t3} = 0.064\left(\frac{100}{40}\right)\left(\frac{220}{220}\right)^2$

0.16 pu

" " T_4: $X_{t4} = 0.08\left(\frac{100}{40}\right)\left(\frac{110}{110}\right)^2 =$

0.2 pu

For moter. $X_{sm} = 0.185\left(\frac{100}{66.5}\right)\left(\frac{10.45}{11}\right)^2$

$= 0.25 \text{ pu}$

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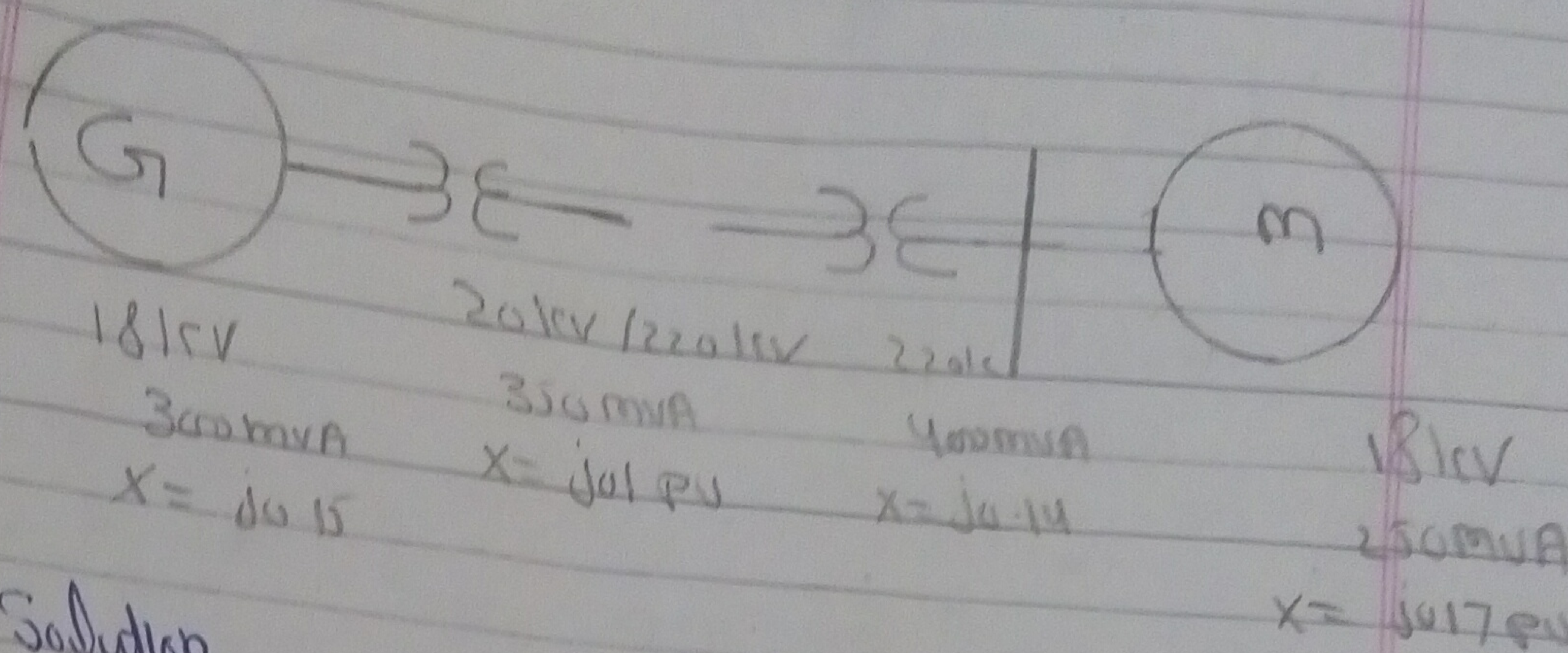
Question No = 5



Solution =

Per fault

$V_0 = \frac{17.8 kV}{12.66} = 0.140$

All resistance are given in base 20 MVA and apparent voltage

Load = 200 MVA, 0.80 power factor Leading.

$\frac{200}{10} = 10 p.u$

=> per fault current

$I_0 = \frac{10}{0.140 \times 0.80}$

$\frac{10}{}$

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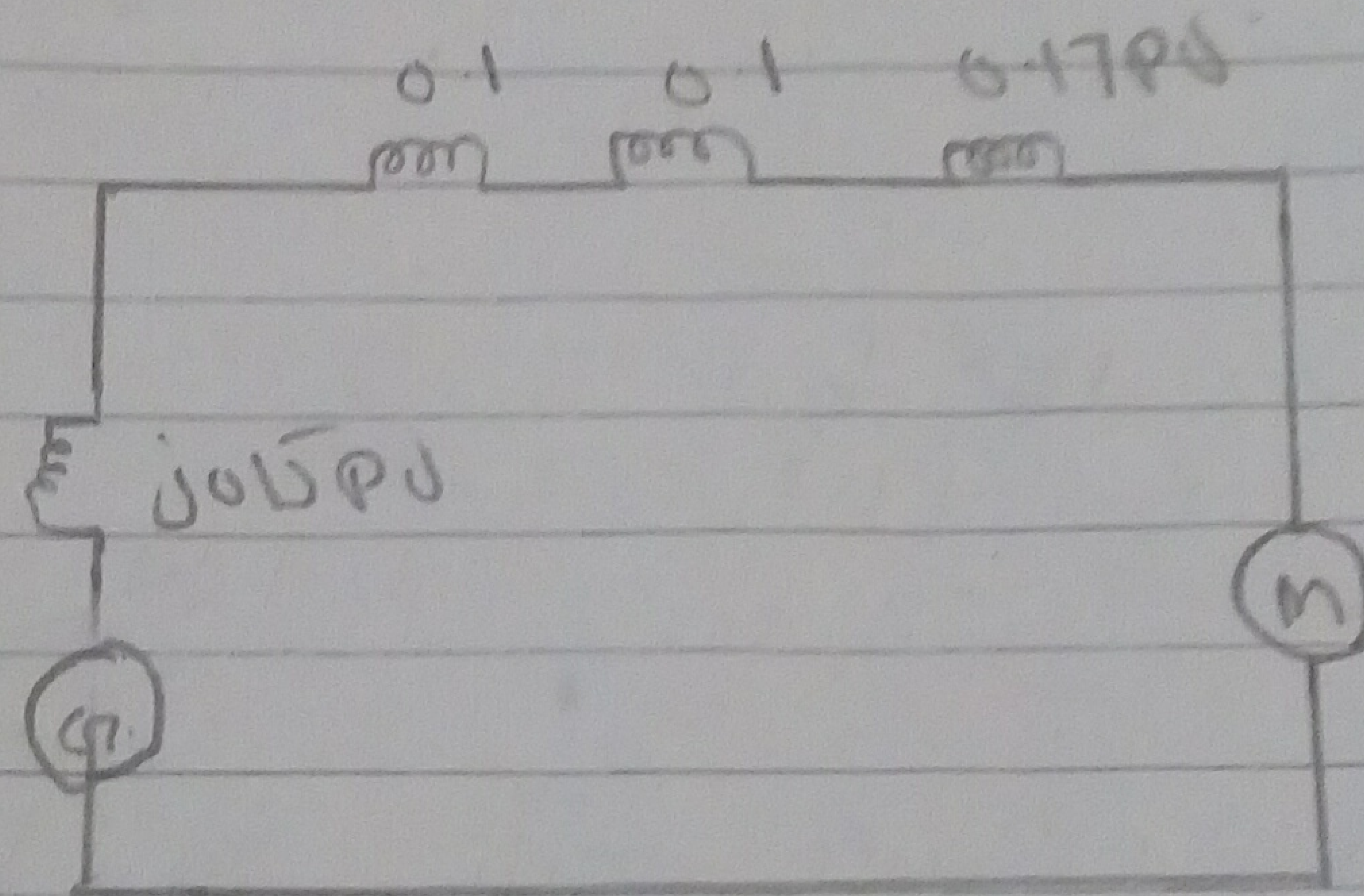
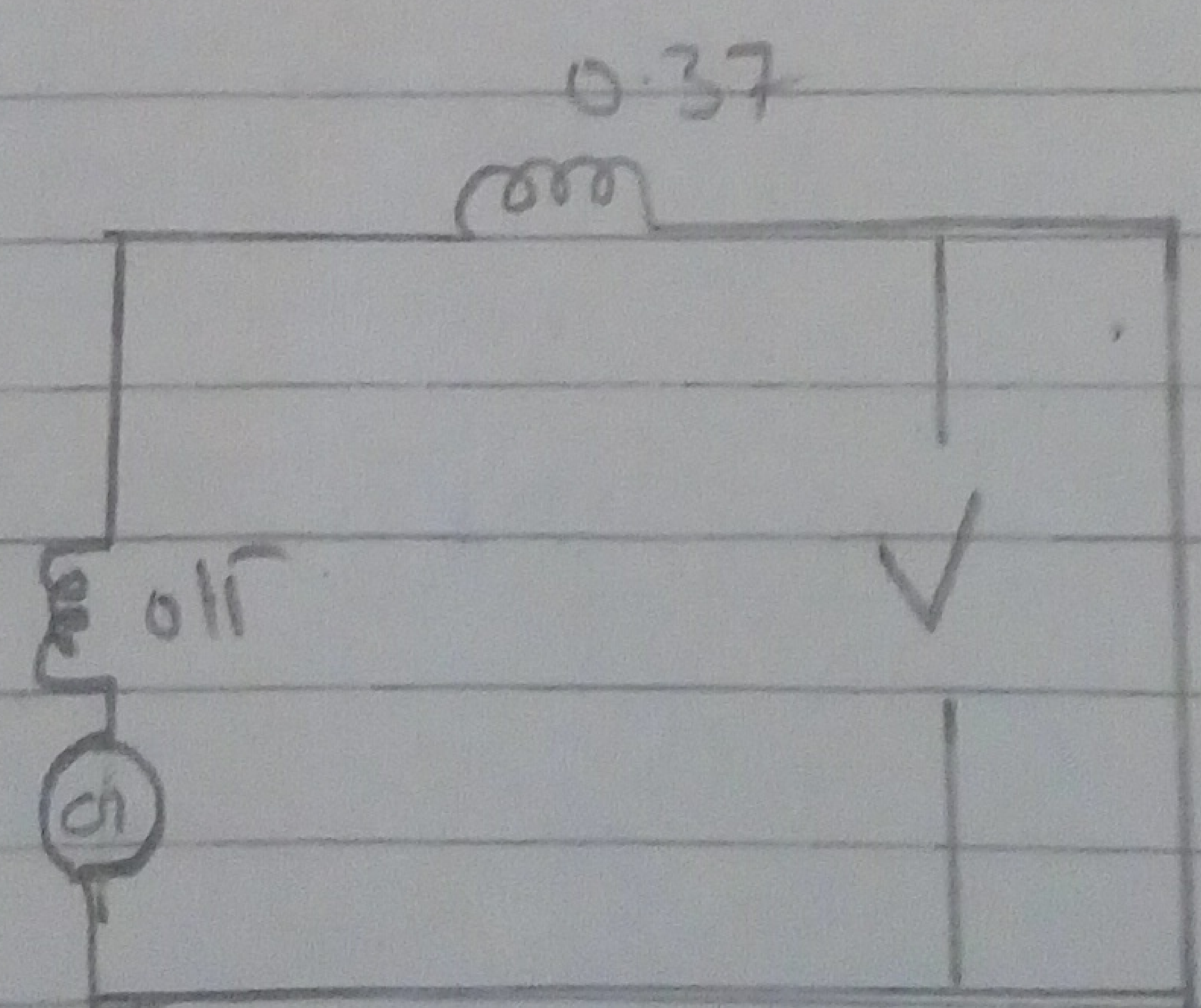
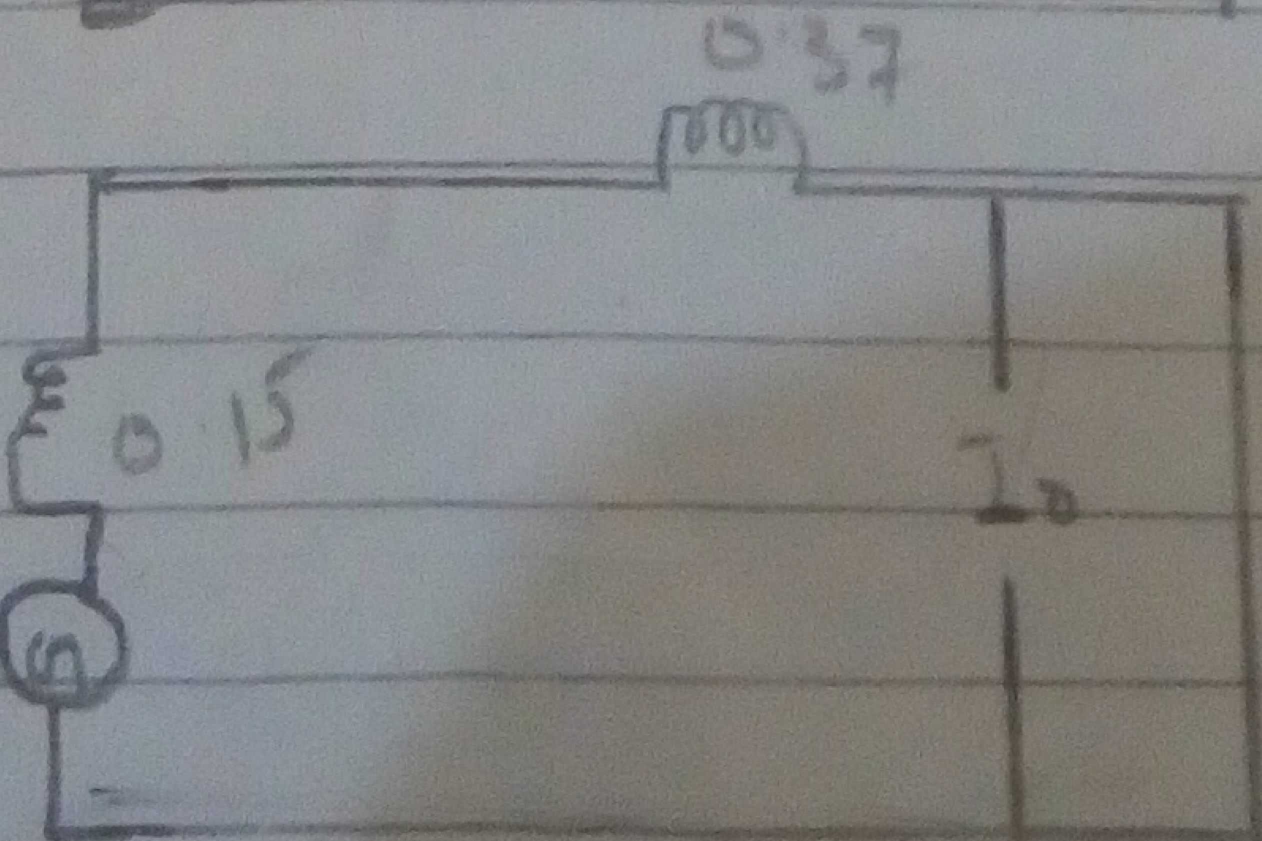
$$\Rightarrow \frac{10}{0.112}$$

89.2857

Perfault equvalent ckt







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Q Question No = "6"

Ans =

overcurrent protective devices must operate to isolate short circuit fault safely, minimize damage to circuit element and avoid if ~~possib~~ possible, shut down of plant. An accurate knowledge prospective fault current through out the system is essential for the correct application of protective devices and the design busbar and terminal arrangement to withstand consequential mechanical and thermal stresses.