M. Usama ① ID # 14150

Q = 1 Part # (A)

solution:

Primary = 130 kV

secondary = 10 kV

T/F Rated = 30 MVA

Z_b across V_{base1} (130 kV)

$$Z_b = \frac{(130 \times 10^3)^2}{30\ MVA} = \frac{169\cancel{00000000}}{30\ \cancel{000000}}$$

$$\boxed{Z_b = 56.33}$$ Ans

⇒ Z_b across V_{base2} (10 kV)

$$Z_b = \frac{(10 \times 10^3)^2}{30\ MVA}$$

$$= \frac{10\cancel{0000000}0}{3\cancel{0000000}}$$

$$\boxed{Z_b = 3.33}$$ Anss

Q = "1" Part # "B"

Solution :-

Primary
$11/132\ KV_{sec}$

We know That for S_{base1}

$$I_{base1} = \frac{S_{base1}}{V_{base1}}$$

$$S_{base1} = V_{base1} \times I_{base1}$$

$$= 11 \times 10^3 \times 909\ Amp$$

$$S_{base1} = 9999000$$

Now S_{base2} :-

$$S_{base2} = V_{base2} \times I_{base2}$$

$$= 132 \times 10^3 \times 75.75\ Amp$$

$$S_{base2} = 9999000$$

Now S_{base1} :-

$$Z_{base1} = \frac{(V_{base1})^2}{S_{base1}} = \frac{(11 \times 10^3)^2}{9999000} = 12.101$$

$$\boxed{Z_{base1} = 12.101}$$

Now Z_{base2} :-

$$Z_{base2} = \frac{(V_{base2})^2}{S_{base2}} = \frac{(132\times10)^2}{9994000} = 1742.6$$

$$Z_{base} = 1742.574$$

⇒ Now per unit equilent impedance for Z_{base1}

⇒ $$Z_{base1}\ eq.P.U = \frac{Z_{eq1}}{Z_{base1}} = \frac{10\Omega}{12.101}$$

$$Z_{base1}\ eq.P.U = 0.826$$

⇒ For Z_{base2}

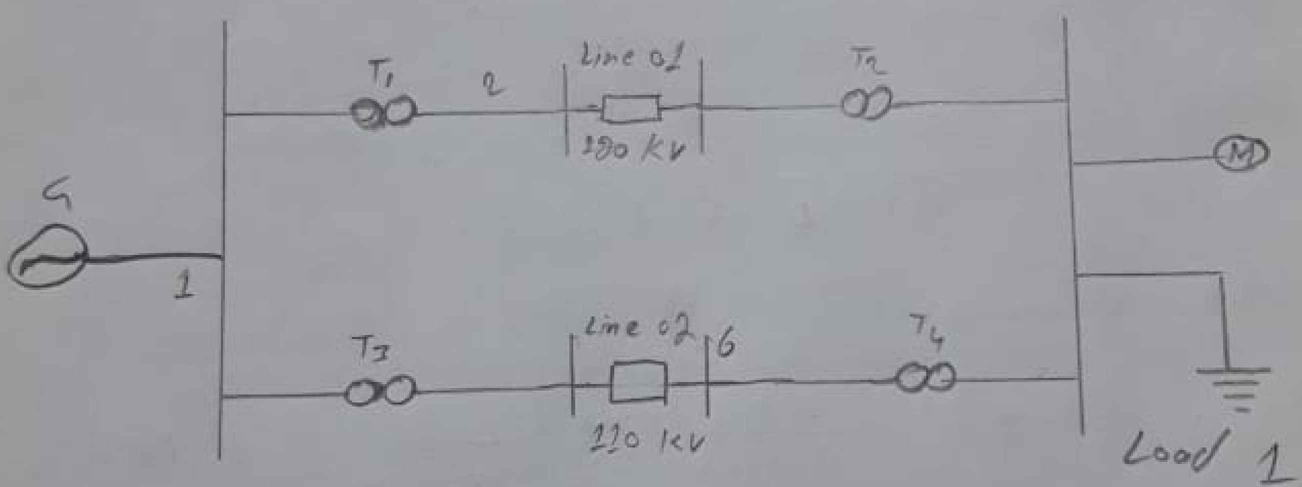
$$Z_{base}^{eq.P.U} = \frac{Z_{eq2}}{Z_{base2}} = \frac{1440\Omega}{1742.574} = 0.826$$

$$Z_{base2}\ eq.P.U = 0.826$$

M. Usama (4) ID # 14150

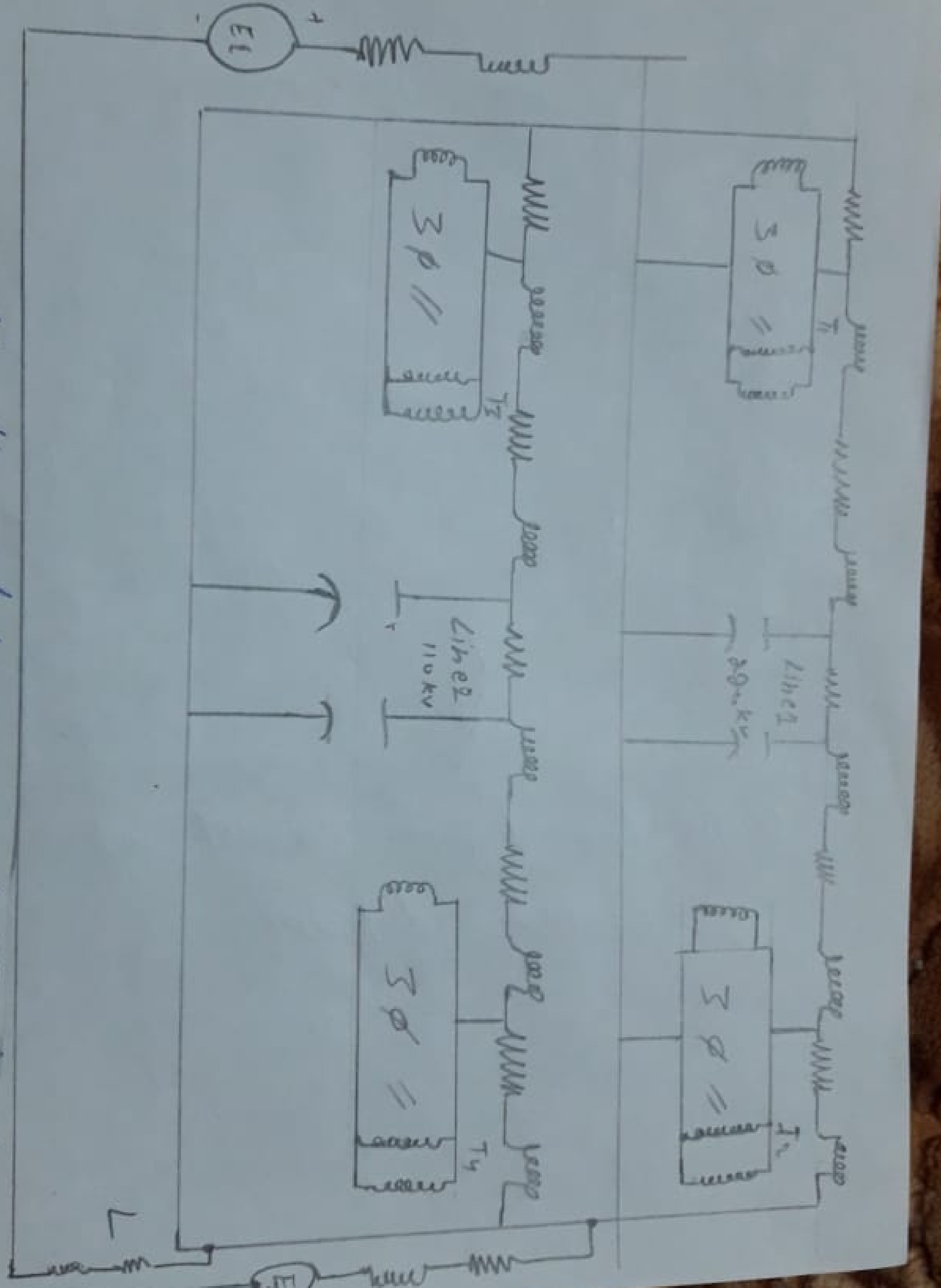
Q = 2

single line diagram of a 3ϕ Power system is shown is The below figure Draw an impedance and reactance diagram in P.U.



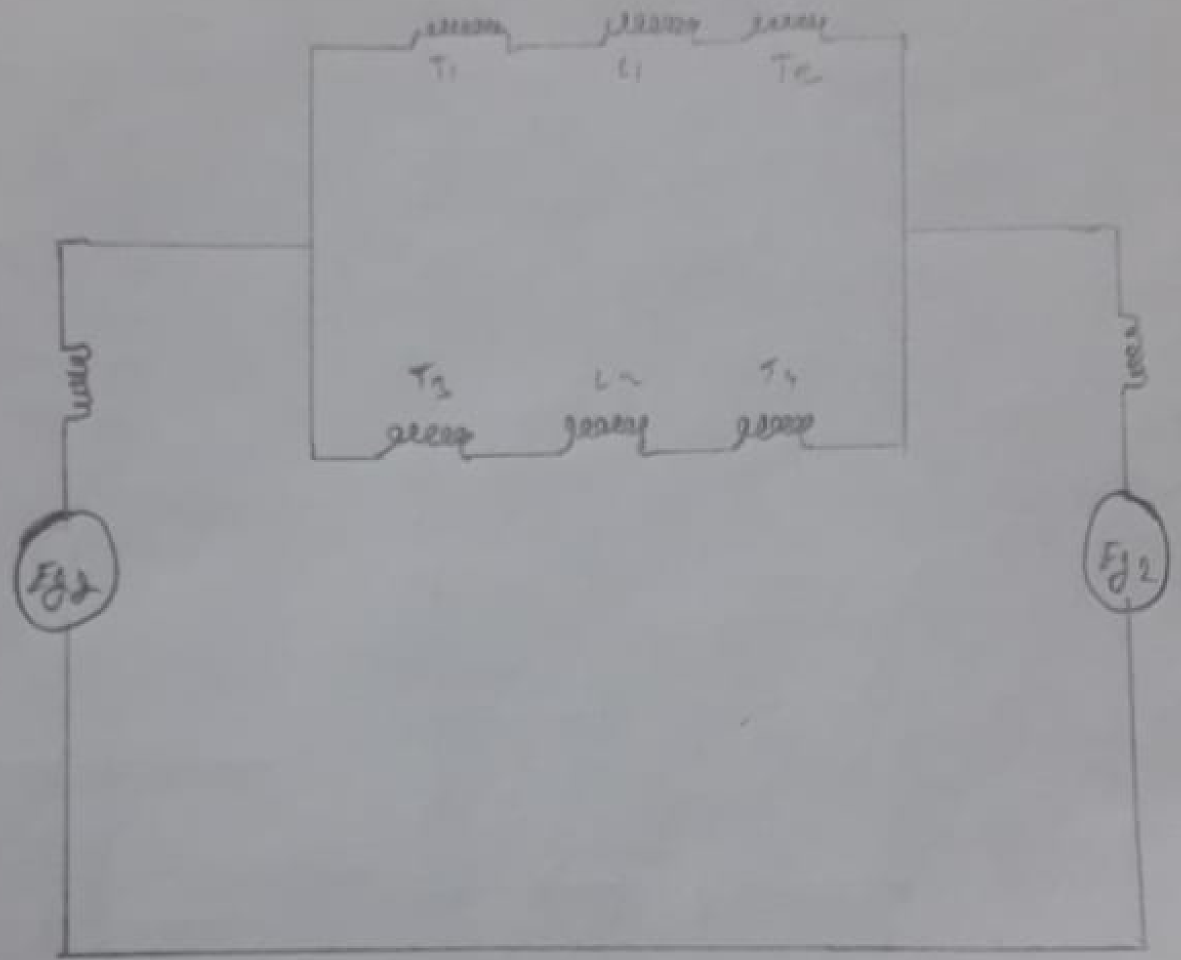
P - T - O

M. Usama 5 ID # 14150



Single line diagram convert To Impedance Diagram

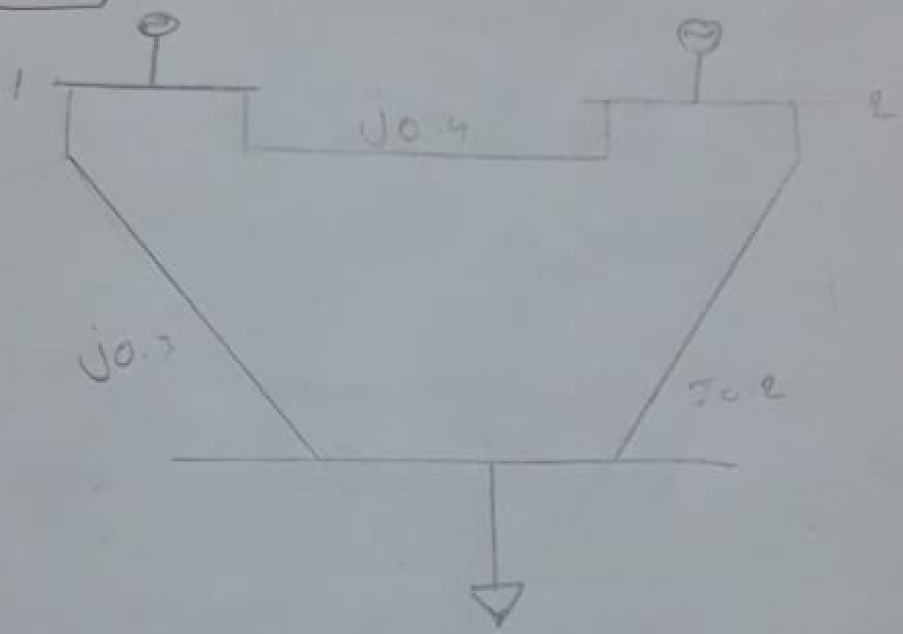
M. Usman (6) ID # 14150

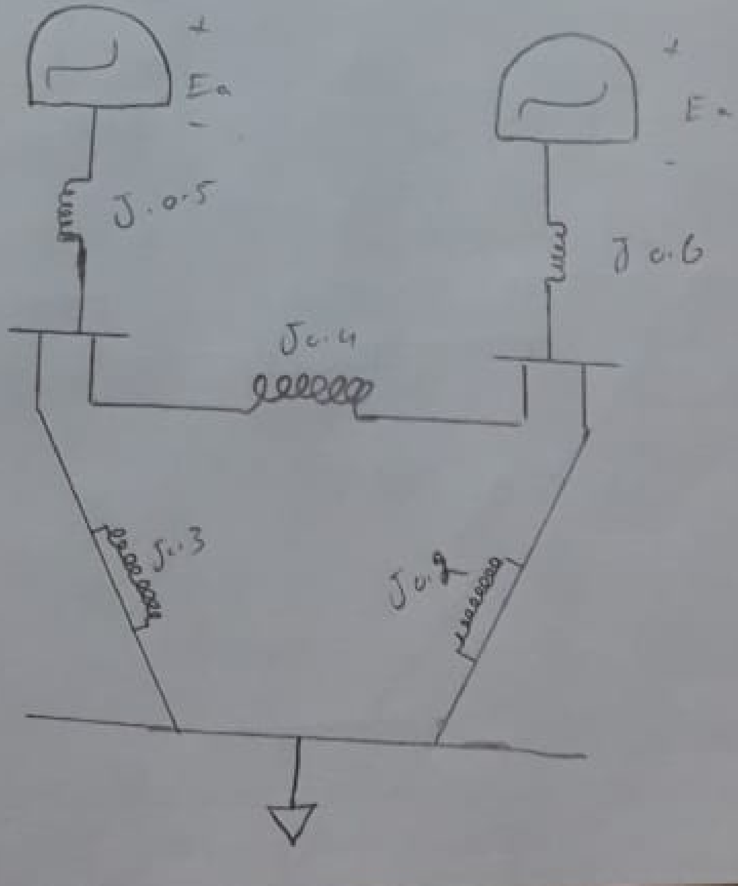


Single line diagram convert into Reactance diagram.

M. Usama ⑦ ID # 14150

$\boxed{Q = 3 \ (a)}$



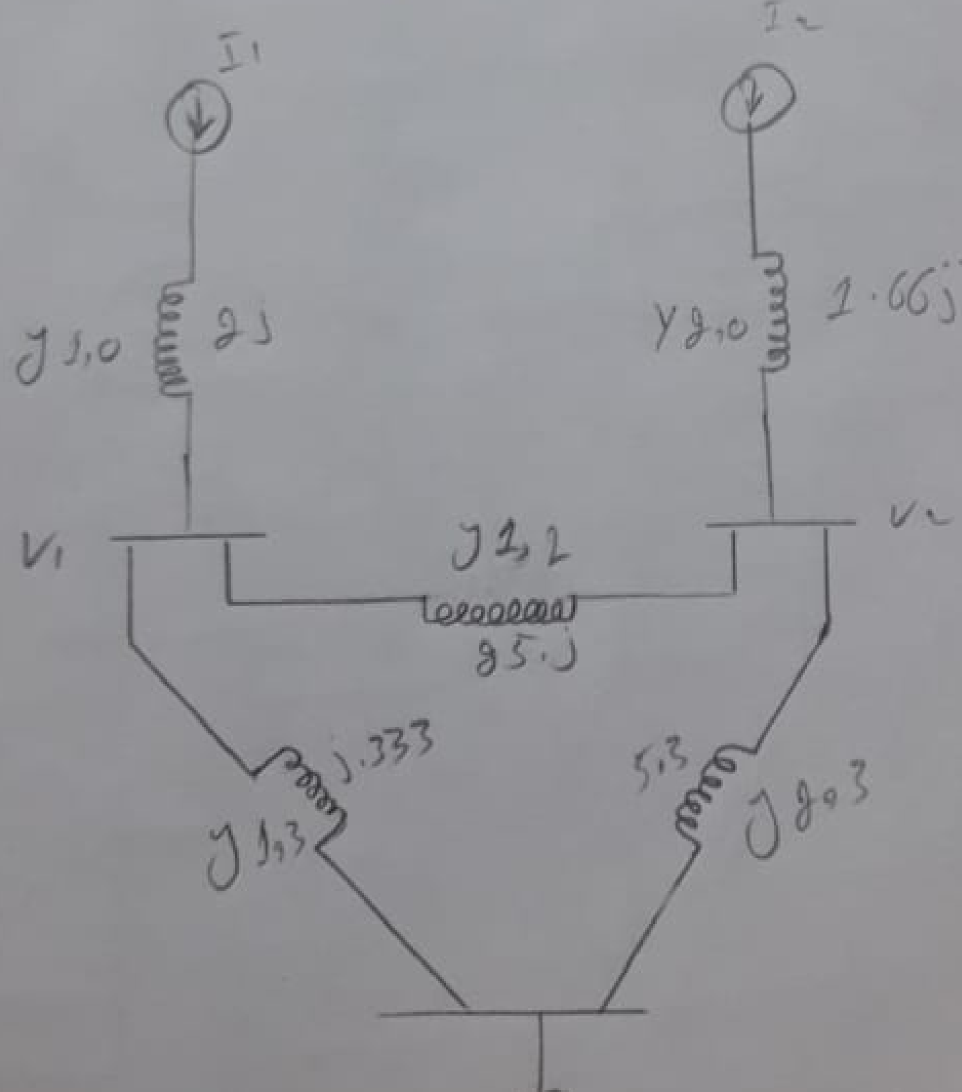


Now calculation :-

$\frac{1}{J0.6} = 160$ $\frac{1}{J0.5} = 2$ $\frac{1}{J0.4} = 25$ $\frac{1}{J0.3} = 333$

$\frac{1}{J0.2} = 5$

⇒ So Now We convert The reactance diagram into Admittance.



Now we apply KCL equation:-

Node (1)

So

$I_1 = Y_{1,0}\ V_2 + y_{1,2}(V_1 - V_2) + y_{1,3}(V_1 - V_3)$

$[Y_{1,0} V_1 + Y_{1,2} V_1 - Y_{1,2} V_2 + Y_{1,3} V_1$
$Y_{1,3} V_3]$

Now V_1 common

$V_1 = V_1(Y_{1,0} + Y_{1,2} + Y_{1,3}) - Y_{1,2} V_2 - Y_{1,3} V_3$

$I_1 = V_1 [Y_{1,0} + Y_{1,2} + Y_{1,3}] - Y_{1,2} V_2 - Y_{1,3} V_3)$

eq (1)

Now Node 2

$I_2 = Y_{2,0} V_2 + Y_{1,2}(V_2 - V_1 + Y_{2,3}(V_2 - V_3))$

common $\leftarrow [-y_{1,2}\ V_1]$

$= -Y_{1,2} V_1 (y_{2,0} + y_{1,2} + y_{2,3})$

$[V_2 - V_{2,3} - V_3]$