Department of Electrical Engineering

Assignment

Date: 20/04/2020

Course Details

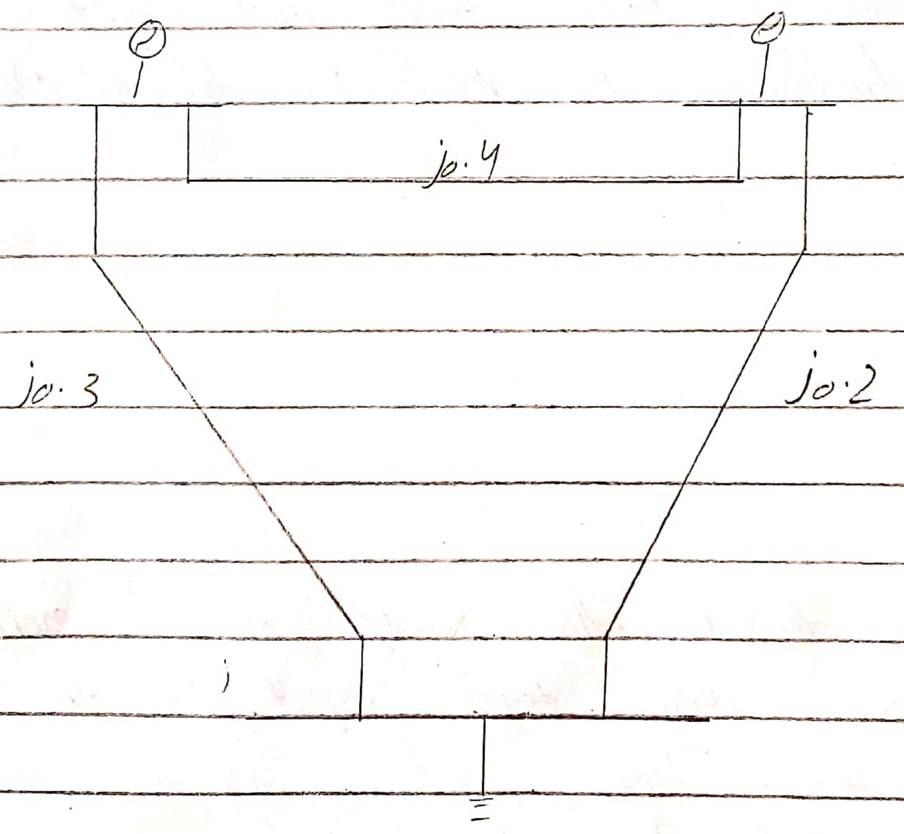
Course Title:	Power System Analysis	**Module:**	6th
Instructor:	Engr. Aamir Aman	**Total Marks:**	30

Student Details

Name:	Sifatullah	**Student ID:**	~~14200~~ 14200

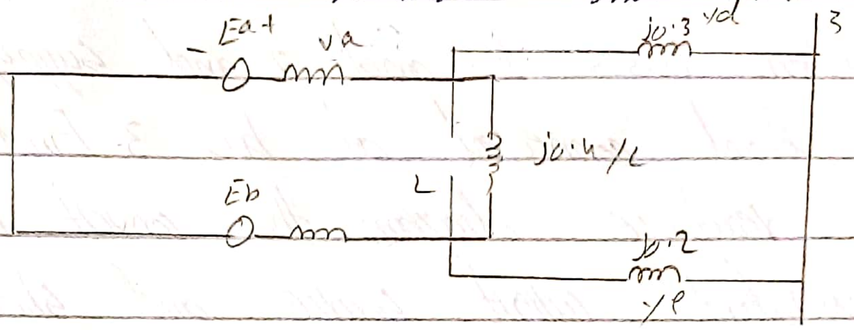
Sifatullah ID 14200

Q3a For the single line diagram shown below. Generator are connected to high Tension buses 1 and 2 and supply to load connected at bus 3. Find the reactance diagram. the convert into equivalent current source and shunt admittance. The find the admittance matrix and find the total current.

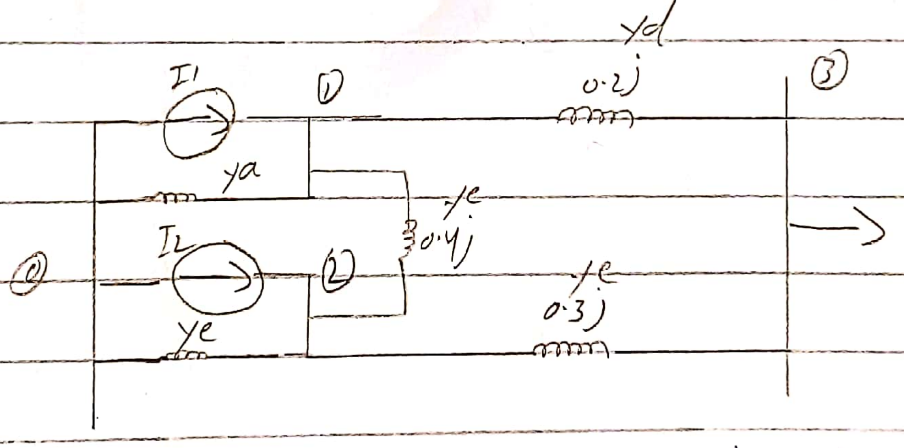


Ans: For all analysis all machines and any one bus are treated as a single machine and represented by a single emf and series resistance.

The reactance diagram will be as follows with reactance show below:



If the ckt is redrawn with emf and impedence in series replaced by equivalent current source and shunt admittance. The result is following ckt:



To designate the voltage at ~~at~~ each buses with ~~respect~~ respect to the neutral. Take node 0 as a reference.

Apply KCL node 1

$I_1 = v_1 y_a + (v_1 - v_2) y_c + (v_1 - v_3) y_d$

$I = v_1 (y_a + y_c + y_d) - v_2 y_c - v_3 y_d$ ①

Similarly at node 2

$I_2 = v_2 (y_b + y_c + y_e) - v_1 y_c - v_3 y_e$ ②

node 3

$I_3 = V_3(Y_d + Y_e) - V_1 Y_d - V_2 Y_e \rightarrow (3)$

The standard form the the undgrate.

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} Y_{11} & Y_{12} & Y_{13} \\ Y_{21} & Y_{22} & Y_{23} \\ Y_{31} & Y_{32} & Y_{33} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} - (5)$$

eq (5) is desponted as Ybus and called the buss admittance matrix. The admittance Y_i are called and self admitance. at the node and each equal the sum of all the admitances form on the node. The otten admitance are called mutual admitance.

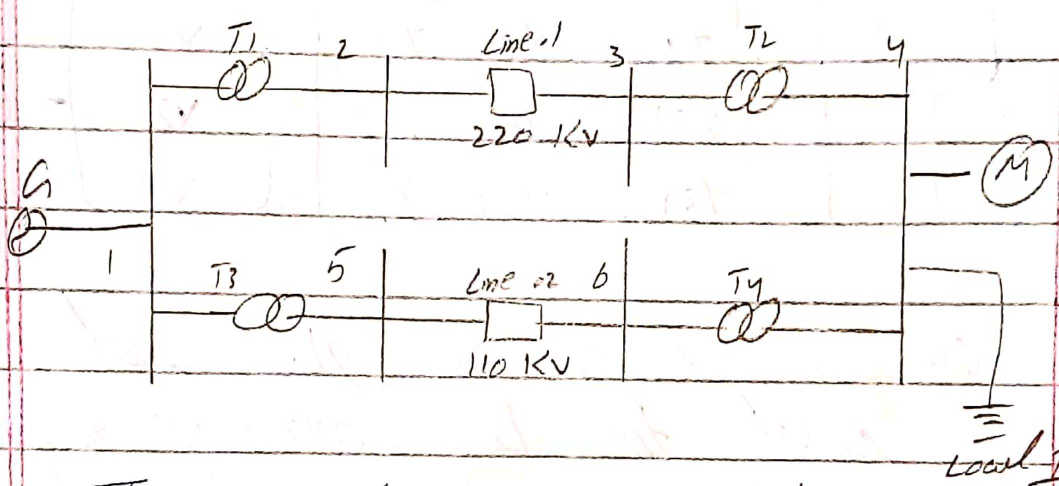
$$\begin{bmatrix} I_1 \\ I_2 \\ 0 \end{bmatrix} = \begin{bmatrix} Y_a + Y_c + Y_d & -Y_c & -Y_d \\ -Y_c & Y_b + Y_e + Y_e & -Y_e \\ -Y_d & -Y_e & Y_d + Y_e \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}$$

$$I_T = I_1 + I_2$$

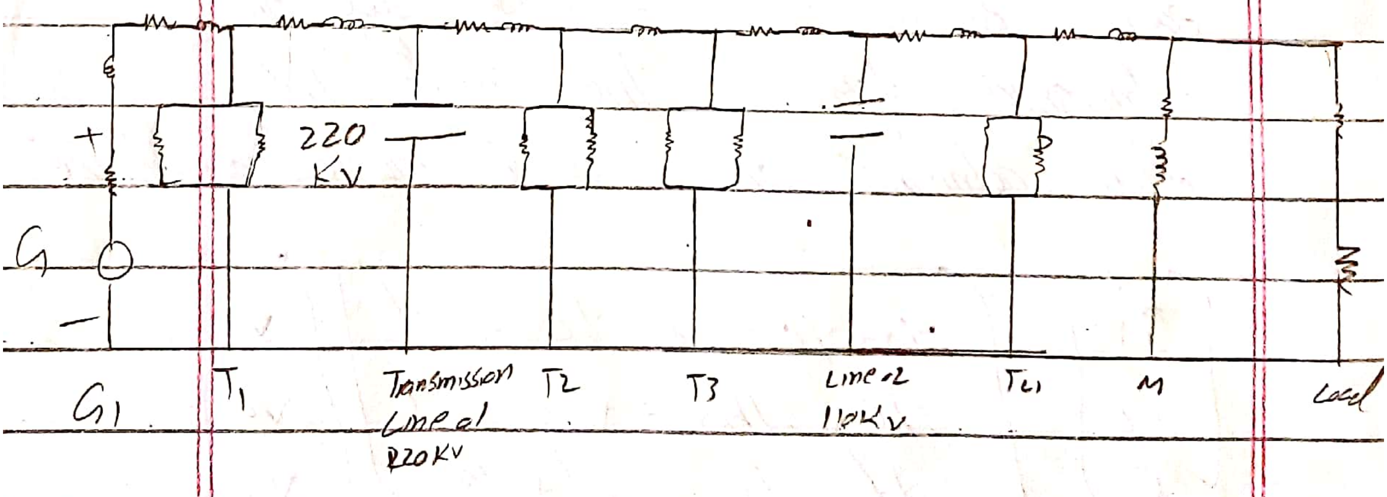
$$\begin{bmatrix} I_1 \\ I_2 \\ 0 \end{bmatrix} = \begin{bmatrix} Y_a + 0.6j & -0.4j & -0.2j \\ 0.4j & Y_b + 0.7j & -0.3j \\ -0.2j & -0.3j & 0.5j \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}$$

Sifatullah ID 14200

Q2 a) Single line diagram of 3ϕ power system in shown in the below figure. Draw an impedance and reactance diagram in p.u.

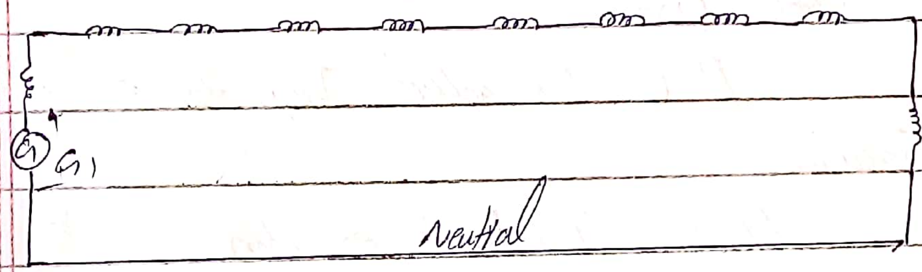


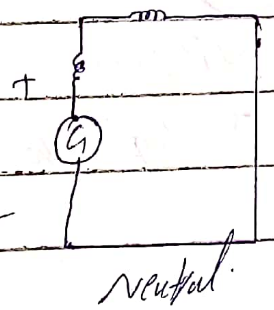
Ans: The impedance diagram of above system can be draw as



The resistance often omitted when making fault calculation because the inductive resistance of a system is much larger than its resistance.

If we decide to simplify our calculation of faults current by omitting all static load all resistance and capacitance of transmission line. The enduce diagram reduces to the resistance diagram Two simplification apply the fault calculation only.





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Q1 (b) Find the per unit equivalent impedence of an 11/132 Kv transformer having 10 Ω 1440 Ω, the equivalent impedence. The primary and secondary current are 909 Amp and 75.75 amps respectively.

Ans Solution: Given ~~data~~ Quantities:

$V_P = 11\ KV$

$V_S = 132\ KV$

$I_P = 909\ Amp$

$I_S = 75.75\ Amp,\ Z_1 2P \cdot Z_2 = 25$

impedance $= 10\Omega,\ 1440\ \Omega$

Required Data:

P.U Equivalent Impedance = ?

Solution:

From Transformer equation

$V_P / V_S = I_S / I_P = N_P / N_S = K$ ① eq

$$Z_1 PU = \frac{Z_1}{Z_2} = \frac{Z_1}{V_P / I_P}$$

$$Z_1 PU = Z_1 \times I_P / V_P = 10 \times \frac{909}{11000} = 0.826$$

$$Z_2 PU = Z_2 \times I_P / V_S$$

$$Z_2 PU = 1440 \times \frac{75.75}{13200} = 0.82$$

Hence PU equivalent Impedance of T/F is same refered to primary or secondary.

$$\boxed{Z_1 PU = Z_2 PU}$$

x x x x