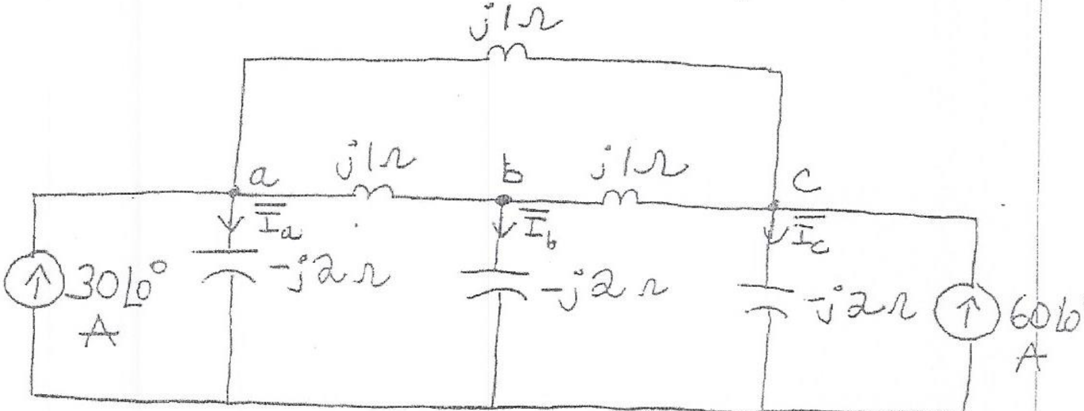
H.W. #9 Due: Wed., April 8

#1) Given the ckt. shown below,



a.) Use the fact that

Y_{ii} = sum of admittances directly connected to node i

Y_{ij} = − (sum of admittances connected between nodes i and j)

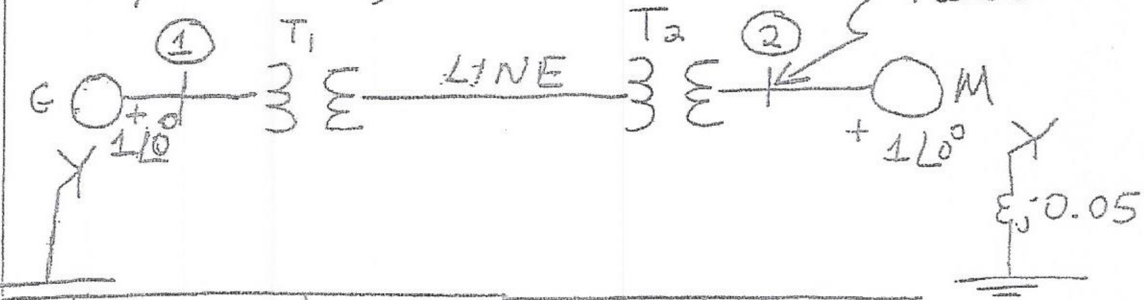
to write down the nodal equations in matrix form.

b.) Find $\overline{V}_a$, $\overline{V}_b$, $\overline{V}_c$ using symmetrical components.

c.) Now find $\overline{I}_a$, $\overline{I}_b$, and $\overline{I}_c$.

#2)

For the system shown below (all values in per-unit):

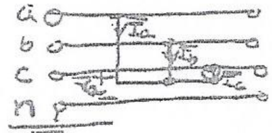


	$\bar{Z}_0$	$\bar{Z}_1$	$\bar{Z}_2$
Generator	j0.05	j0.15	j0.17
Motor	j0.10	j0.20	j0.21
Transf. 1	j0.10	j0.10	j0.10
Transf. 2	j0.10	j0.10	j0.10
Line	j0.105	j0.105	j0.105

a.) Draw the positive-sequence network and determine the Thevenin equivalent from bus ② to ground.

b.) Calculate the fault voltage and the fault current for a symmetrical fault at bus ②, with $\bar{Z}_F = 0$ (bolted short).

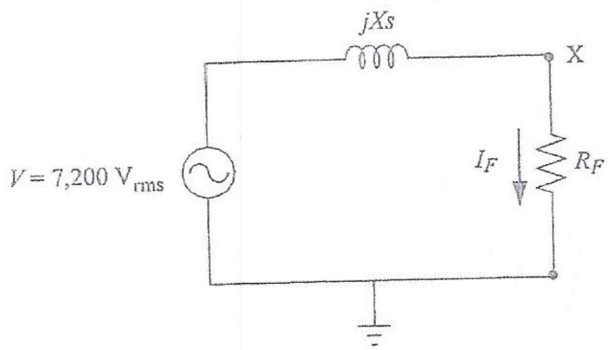
c.) Calculate $\bar{I}_a$ for this 3ϕ fault. Also calculate $\bar{I}_b$ and $\bar{I}_c$.



#3)

The diagram below represents the Thevenin equivalent of a single-phase distribution system. A fault occurs between point X and ground. R_F represents the fault resistance. The current I_F is 3,600 A when R_F is 0 Ω. If R_F is changed to 1.0 Ω, the current I_F (amperes) is most nearly:

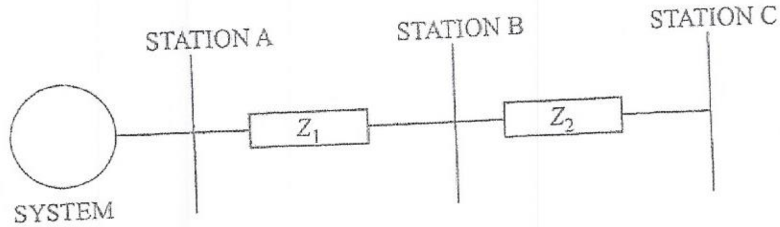
(A) 2,000
(B) 2,400
(C) 3,200
(D) 4,600



#4.)

Consider the 60-kV transmission system below. Transmission line impedances are:

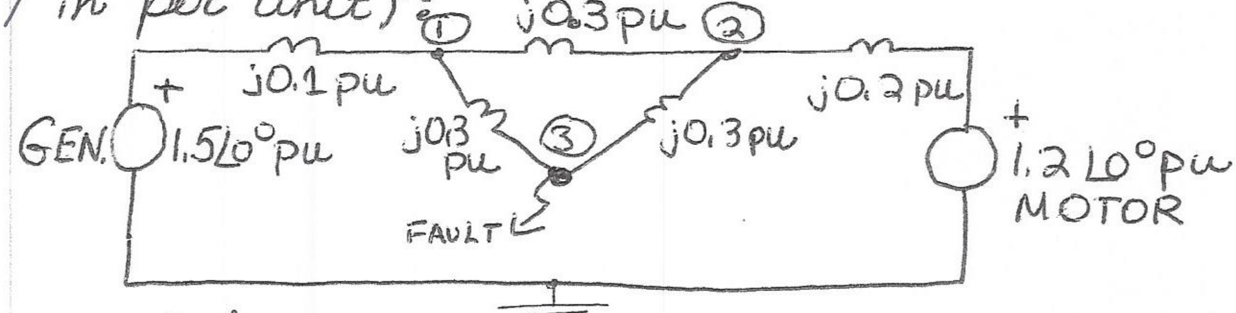
$Z_1 = 16.75\angle 71^\circ\ \Omega$
$Z_2 = 13.4\angle 71^\circ\ \Omega$



With a system impedance of $13.25\angle 81^\circ\ \Omega$, the 3-phase fault current (amperes) at Station C is most nearly:

(A) 2,590
(B) 1,495
(C) 1,285
(D) 800

#5.) For the system shown below (all values in per unit):



a.) Redraw the ckt. with the Δ changed to Y. See hint.
b.) Using the ckt. obtained in a, determine the Thevenin equivalent from bus ③ to ground.
c.) Calculate the fault voltage and the fault current for a symmetrical fault at bus ③ with $\bar{Z}_F = j0.01$ pu.
d.) Calculate the fault current through each one of the two machines. Let $\bar{I}_{g1}$ and $\bar{I}_{m1}$ be these currents. If $\bar{I}_{g1} = \bar{I}_{ag}$, what is $\bar{I}_{bg}$ and $\bar{I}_{cg}$? If $\bar{I}_{m1} = \bar{I}_{am}$, what is $\bar{I}_{bm}$ and $\bar{I}_{cm}$?

Hint: