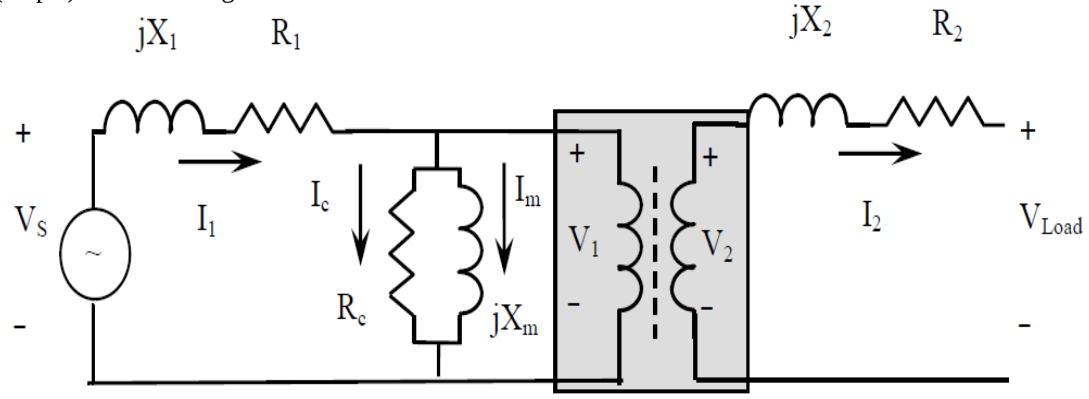
Name:_____

EE 303, Quiz 4, Spring 2017, Dr. McCalley

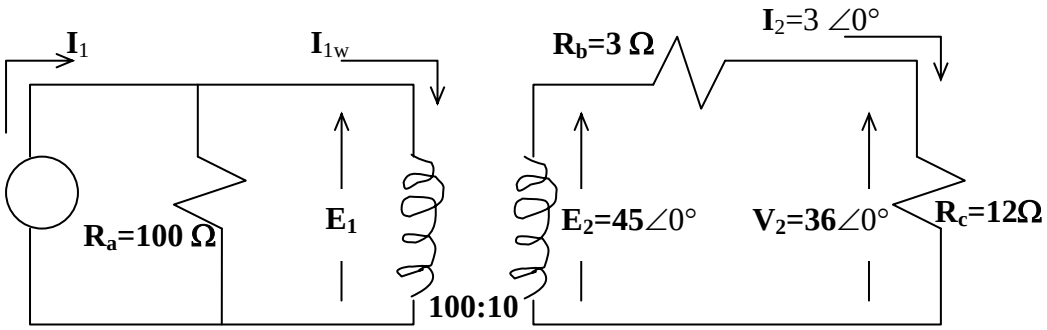
1. (30 pts) The following is a circuit model of a transformer.



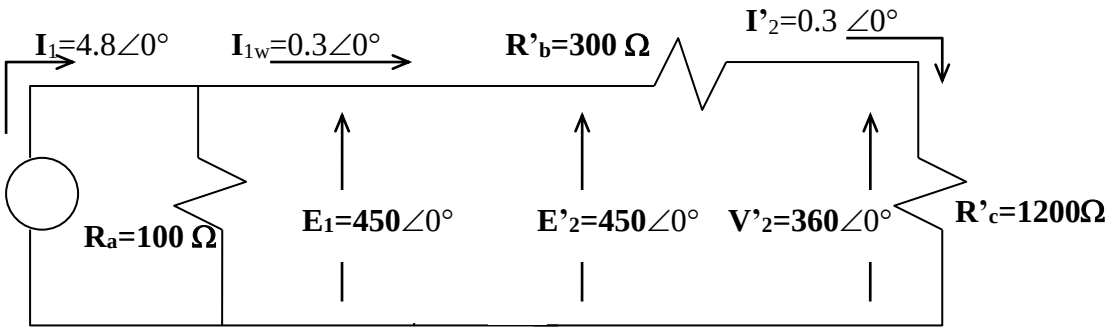
Answer the following questions:

a. What element or elements model the leakage flux? ___X_1 and X_2_____
b. What element or elements model the real power losses caused by eddy currents in the transformer core?__R_c_____
c. What element or elements model the hysteresis losses in the transformer core?_____R_c_____
d. What element or elements model the real power losses caused by I^2R effect in the windings?_____R_1 and R_2_____
e. What element or elements model the reactive power associated with setting up the magnetizing flux in the core?_____X_m____

2. (40 pts) In the circuit below, the primary turns is N_1=100 and the secondary turns is N_2=10. Refer all of the numerical quantities indicated over to the primary side and draw the primary-side circuit you would use for analysis. Label the resistant elements appropriately and give their valu[illegible]hasor quantities on your diagram, and for each one, give the corresponding numerical value: $\mathbf{V'_2, E'_2, I'_2, E_1, I_{1w}, I_1}$.



Solution:



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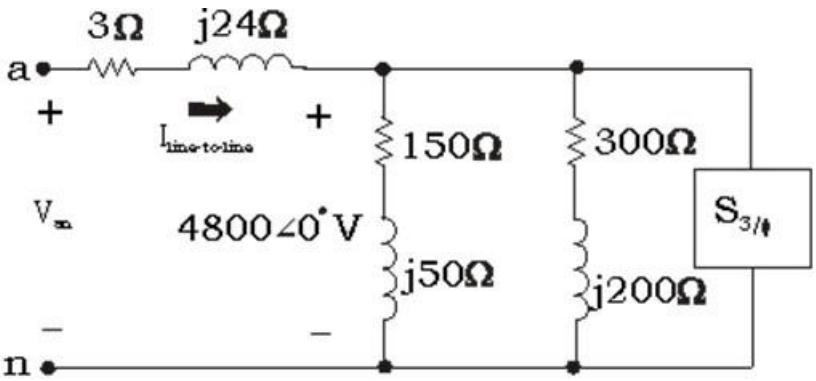
3. (30 pts) Consider the following circuit which is exactly the same as the one discussed in the last class. It is a per-phase circuit of a three-phase system. The three phase power consumed by load #3 is 95.04 kVA at 0.6 pf leading.



Choose your base line-to-neutral voltage as 5000volts and your base per-phase power as 100,000volt-amperes.

a. Compute the base line current.
b. Compute the base impedance for Y-connected loads.
c. Compute the per-unit voltage applied at load.
d. Compute the per-unit power consumed by load #3.
e. Compute the per-unit impedances for the impedance of the two constant impedance loads.

Solution:

a. $I_{base}=S_{1,base}/V_{LN,\ base}=100{,}000/5000=20$ or $I_{base}=S_{3,base}/(\text{sqrt}(3)V_{LL,\ base})=300{,}000/\text{sqrt}(3)\text{sqrt}(3)5000=20$amps.
b. $Z_{base}=V_{LN,base}/I_{base}=5000/20=250$ohms or $Z_{base}=(V_{LL,base})^2/S_{3,base}=(\text{sqrt}(3)*5000)^2/300{,}000=250$ohms
c. $V_{pu,load}=4800/5000=0.96$pu
d. $S_{3,pu}=95{,}040(0.6\text{-}j0.8)/300{,}000=0.3168(0.6\text{-}j0.8)$
e. $Z_{1,pu}=(150+j50)/250=(0.6+j0.2)$pu; $Z_{2,pu}=300+j200//250=(1.2+j0.8)$pu.