Name:_____

EE 303 Quiz 2, Spring 2017, Dr. McCalley, February 2, 2017
20 minutes, Closed book, Closed Notes, Calculator Allowed

1. (24) A Wye-connected load, with a-b-c phase sequence, has a line-to-neutral voltage magnitude of 120 volts. Assume the a-phase line-to-neutral voltage is reference. Identify the following phasors (**magnitude and angle**).

   $\mathbf{V}_{an}$=___120∠0°_____ $\mathbf{V}_{ab}$=_(√3)(120) ∠30° __

   $\mathbf{V}_{bn}$=____120∠-120°____ $\mathbf{V}_{bc}$=_(√3)(120) ∠-90° __

   $\mathbf{V}_{cn}$=_____120∠-240°____ $\mathbf{V}_{ca}$=_(√3)(120) ∠-210° __

2. (24) A Delta-connected load, with a-b-c phase sequence, has a line current magnitude of 10 amperes. Assume the a-phase line current is reference. Identify the following phasors (**magnitude and angle**).

   $\mathbf{I}_{a}$=_10∠0° _____ $\mathbf{I}_{ab}$=_(10/√3) ∠30° _

   $\mathbf{I}_{b}$=__10 ∠-120_____ $\mathbf{I}_{bc}$=_(10/√3) ∠-90° _

   $\mathbf{I}_{c}$=__10 ∠-240_____ $\mathbf{I}_{ca}$=_(10//√3) ∠-210° _

3. (28) A 3-phase line has an impedance of 0.4+j2.7 ohms/phase. The line feeds 2 balanced 3-phase loads that are connected in parallel. The first load is absorbing 560.1kVA at 0.707 power factor lagging. The second load absorbs 132 kW at unity power factor. The line-to-neutral voltage at the load end of the line is 2200 volts. Determine the total real and reactive power loss in the line.

   Solution:

   The total complex power is

   $$S_{R(3\phi)} = 560.1(0.707 + j0.707) + 132 = 528 + j396 = 660\angle 36.87^\circ \text{ kVA}$$

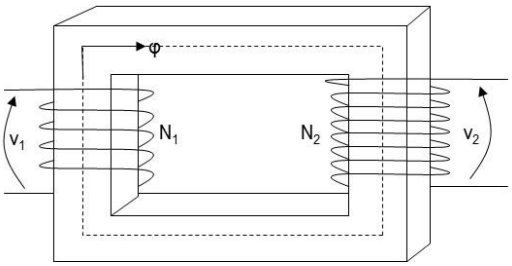
   With the phase voltage $\mathbf{V}_2$ as reference, i.e., $\mathbf{V}_2$=2200/_0°, the current in the line is

   $$I = \frac{S^*_{R(3\phi)}}{3V_2^*} = \frac{660{,}000\angle -36.87^\circ}{3(2200\angle 0^\circ)} = 100\angle -36.87^\circ \text{ A}$$

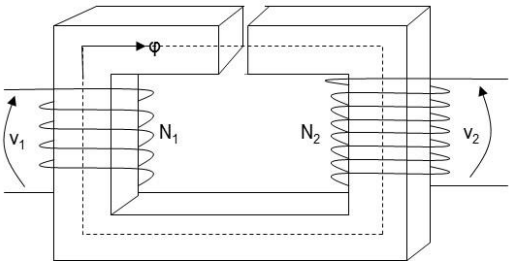
   The three-phase power loss in the line is

   $$S_{L(3\phi)} = 3R|I|^2 + j3X|I|^2 = 3(0.4)(100)^2 + j3(2.7)(100)^2 = 12\,\text{kW} + j81\,\text{kvar}$$

4. (24) Consider the two magnetic circuits illustrated below; the cores of each are ferromagnetic and are identically constructed. Both circuits have N_1 primary coils and N_2 secondary coils. For each question below, assume that identical voltage sources are applied to the primary terminals (v_1).
   i. Which magnetic circuit has the largest reluctance as seen by an applied magnetomotive force at the primary side? **Solution**: (b)
   ii. Assume v_1 is a DC voltage. Is flux flowing in (a) larger, smaller, or equal to the flux flowing in (b)? **Solution**: Larger.
   iii. Assume v_1 is an AC voltage. Which magnetic circuit sees an induced voltage v_2: (a), (b), both, or neither? **Solution**: both.



(a)



(b)