ECE 2210 homework PA2

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Note: In the following problems, you may assume voltages and currents are RMS unless stated otherwise or given as a function of time. Transformers are ideal unless stated otherwise.

1. Read sections 2.28, & 3.8 in your textbook. Note: His secondary windings and currents are backwards.

2. An ideal transformer has 330 turns on the primary winding and 36 turns on the secondary. If the primary is connected across a 110 V (rms) generator, what is the rms output voltage?

3. A transformer has $N_1 = 320$ turns and $N_2 = 1000$ turns. If the input voltage is $v(t) = (255\ V)\cos(\omega t)$, what rms voltage is developed across the secondary coil?

4. A step-up transformer is designed to have an output voltage of 2200 V (rms) when the primary is connected across a 240 V (rms) source.

   a) If there are 150 turns on the primary winding, how many turns are required on the secondary?

   b) If a load resistor across the secondary draws a current of 1.2 A, what is the current in the primary, assuming ideal conditions?

5. The primary current of an ideal transformer is 8.5 A and the primary voltage is 80 V. 1.0 A is delivered to a load resistor connected to the secondary. Calculate the voltage across the secondary.

6. An ideal transformer has a turns ratio ($N = N_1/N_2$) of 1.5 . It is desired to operate a 200 Ω resistive load at 150 V (rms).

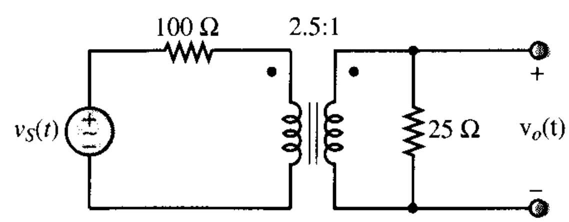
   a) Find the secondary and primary currents.

   b) Find the source voltage ($\mathbf{V_1}$).

   c) Find the power dissipated in the load resistor and the power delivered to the primary from the source.

   d) Find the impedance the source sees looking into the primary winding by calculating $\mathbf{Z_{eq}} = N^2\,\mathbf{Z_L}$ and again by calculating $\mathbf{V_1} / \mathbf{I_1}$.

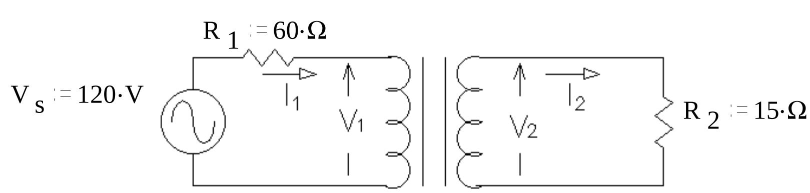
7. For the ideal transformer shown in the figure, find $v_o(t)$ if $v_s(t)$ is $320V\cos(377t)$.



8. The transformer shown in the circuit below is ideal. It is rated at 120/30 V, 80 VA, 60 Hz
   Find the following:

   a) I_1 = ?

   b) V_2 = ?



9. A transformer is rated at 13,800/480 V, 60 kVA, 60 Hz. (Note: kVA stands for kilo-Volt-Amp, in this case it is the transformer's voltage rating times its current rating.) Find the allowable primary and secondary currents at a supply voltage of 12,000 V at 100% power factor. Repeat for a power factor of 50%.

10. An ideal transformer has a rating of 500/125 V, 10 kVA, 60 Hz. It is loaded with an impedance of 5Ω at 80% pf (0.80). The source voltage applied to the primary winding is 440 V (rms). Find:
    a) the load voltage
    b) the load current
    c) the kVA delivered to load
    d) the power delivered to load
    e) the primary current
    f) the power factor of primary
    g) the impedance the source sees looking into primary.

11. An ideal transformer is rated to deliver 400 kVA at 460 V to a customer.

 a) How much current can the transformer supply to the customer?

 b) If the customer's load is purely resistive (i.e. if the pf = 1), what is the maximum power the customer can receive?

 c) If the customer's power factor is 0.8 (lagging), what is the maximum usable power the customer can receive?

 d) What is the maximum power if the power factor is 0.7 (lagging)?

 e) If the customer requires 300 kW to operate, what is the minimum allowable power factor given the rating of this transformer?

Answers

2. 12 V   3. 563 V   4. a) 1375 turns   5. 680 V   b) 11 A

6. a) 0.75 A, 0.50 A   b) 225 V   c) 112.5 W   d) 450Ω

7. 78Vcos(377t)   8. a) 0.4·A   b) 24V

9. 4.35 A, 125 A any pf, (Using the transformer at a lower voltage does not increase its current rating.)

10. a) 110 V   b) 22 A   c) 2.42 kVA   d) 1.94 kW   e) 5.5 A   f) 0.80   g) $80\Omega\angle 36.9^\circ$ Ω

11. a) 870·A   b) 400·kW   c) 320·kW   d) 280·kW   e) 0.75