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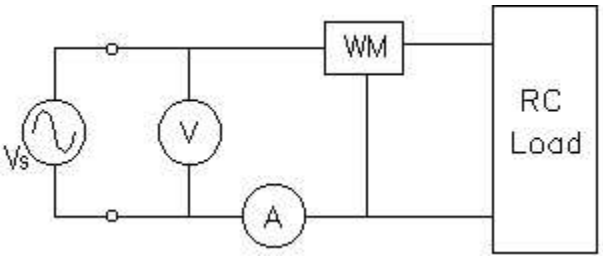
3. (22 pts) For the 60 Hz load shown in the figure, the RMS voltmeter measures 115 V, the RMS ammeter measures 4 A, and the wattmeter measures 300 W. Find the following:

$V_s := 115 \cdot V \qquad I := 4 \cdot A$



a) The real power. P = ?

b) The apparent power. |S| = ?

c) The power factor. pf = ?

d) The power factor is: i) leading ii) lagging
(circle one)

e) The complex power. **S** = ?

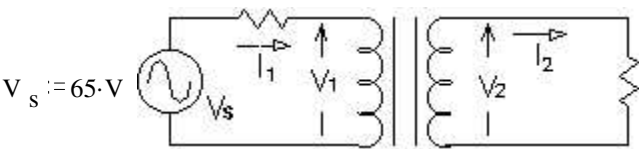
f) Draw the power triangle showing P, Q, and **S**. Write the values of P, Q and S on the drawing. Also calculate and show the angle between P and **S**.
(Q is negative for capacitors. The answer for HW 19, 6.21g incorrectly showed Q as negative for an inductor)

4. (11 pts) The transformer shown in the circuit below is ideal. Find the following:
Don't get stuck on this problem, it's not worth that many points. If you don't know just what to do, go on now and come back later.

a) I_1 = ?

b) I_2 = ?

$R_1 := 100 \cdot \Omega$



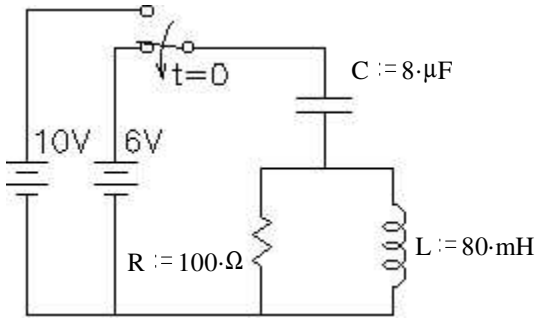
$V_s := 65 \cdot V \qquad R_2 := 25 \cdot \Omega$

$N_1 := 240 \cdot turns \qquad N_2 := 80 \cdot turns$

5. (25 pts) Analysis of the circuit shown yields the characteristic equation and s values below.

The switch has been in the upper position for a long time and is switched down (as shown) at time t = 0. Find the initial and final conditions and write the full expression for $v_C(t)$, including all the constants that you find.

Clearly show important numbers (like initial and final conditions) to get partial credit. If you can't find some of these, guess so that you can move on and demonstrate what you do know.



$$0 = s^2 + \frac{1}{R \cdot C} \cdot s + \frac{1}{L \cdot C}$$

$s_1 := (-625 + 1083 \cdot j) \cdot \frac{1}{sec}, \qquad s_2 := (-625 - 1080 \cdot j) \cdot \frac{1}{sec} \qquad v_C(t) = ?$

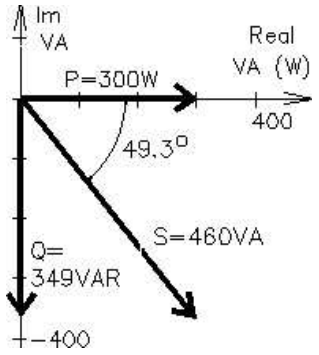
6. (8 pts) The circuit in the previous problem has this characteristic equation: $0 = s^2 + \frac{1}{R \cdot C} \cdot s + \frac{1}{L \cdot C}$
What value of R_1 would make this circuit critically damped?

Answers

1. a) ii) low pass b) 200Hz c) 2nd & 3rd on top row d) 20uF, 31.8mH e) i) -3dB ii) 0.707

2. $A_f = \dfrac{\frac{20 \cdot s}{s + 200}}{1 - \frac{20 \cdot s}{s + 200} \cdot \left(-\frac{5}{s + 300}\right)}$

3. a) 300W b) 460VA c) 0.652 d) leading e) 349VAR f) at right



4. a) 0.2A b) 0.6A

5. $v_C(t) := e^{-625 t} \cdot (4 \cdot V \cdot \cos(1083 \cdot t) - 2.308 \cdot V \cdot \sin(1083 \cdot t)) + 6 \cdot V$

6. 50Ω

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