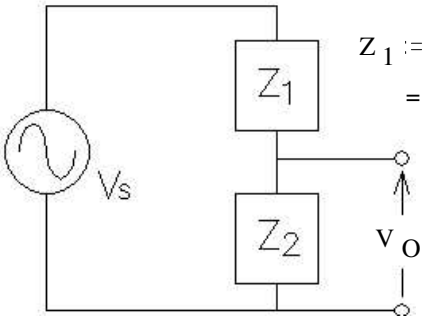
EE1050 Exam 3 given: Spring 2000

(The space between problems has been removed.)

1. (18 pts)
   a) Find V_S in the circuit below. Express it as a magnitude and phase angle (the way V_O is expressed) . Show all the necessary work, not just the results from your calculator.
   b) Consider Z_2 as the load.
      What is the power factor of this load?
   c) How much power is dissipated by Z_2?



$Z_1 := 100\cdot\Omega - 20j\cdot\Omega$

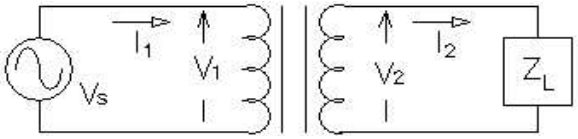
$= 102\cdot\Omega\cdot e^{-j\cdot 11.31\cdot deg}$

$V_O := 1.3\cdot V\cdot e^{j\cdot 18\,deg}$

$Z_2 := 80\cdot\Omega\cdot e^{j\cdot 60\,deg} = 40 + 69.282\cdot j\Omega$

2. (24 pts) Assume the transformer is ideal and all voltages and currents are RMS. The magnitude of the secondary voltage ($|V_2|$) is 48 V.
   a) What is the magnitude of I_2?
   b) What is the power factor of the load?
   c) How much power does the load dissipate?
   d) What is the turns ratio (N) of this transformer?
   e) What is the magnitude of I_1?
   f) What is the magnitude of V_S?
   g) What is the load as seen by V_S? (magnitude and angle)
   h) What is the power factor as seen by V_S?

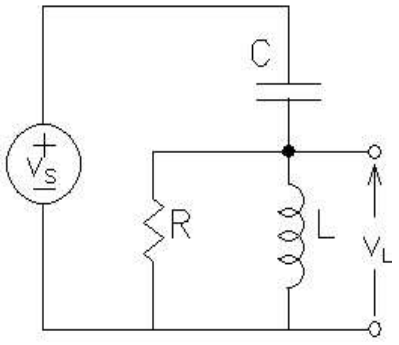
$Z_L := 10\cdot\Omega\cdot e^{-j\cdot 28\,deg}$



$n_1 := 275$ $n_2 := 120$

$V_2 := 48\cdot V$

3. (12 pts) For the circuit show;
   a) Find the differential equation for v_L.
   b) Find the characteristic equation for v_L.



4. (18 pts) Analysis of a circuit for v_X yields the characteristic equation shown.

$$s^2 + 75\cdot s + 1400 = 0$$

   a) Write an expression for $v_X(t)$. You don't have initial and final conditions, so you can't find the constants in this expression. Use letters in place of constants that you cannot find

$v_X(t) =$

   b) This circuit is: overdamped critically damped underdamped (circle one)
   c) Which, if any, of your constants above represents the final condition of v_X?

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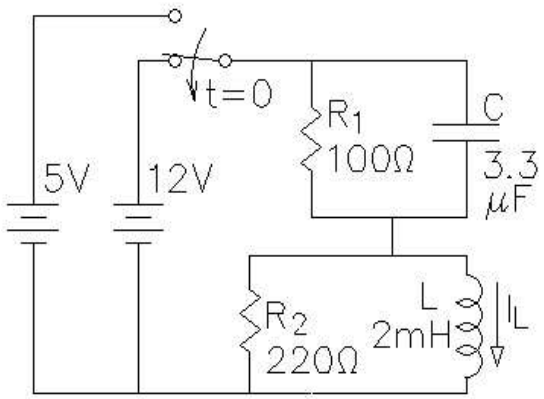
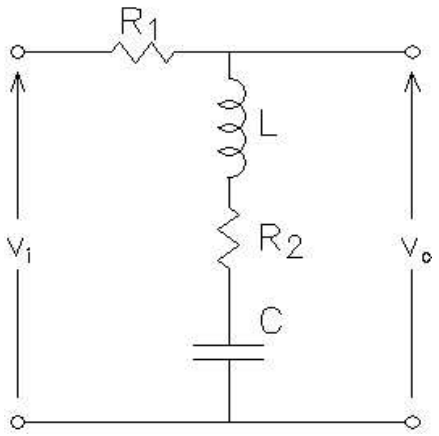
5. (16 pts) Consider the circuit at right. The switch has been in the top position for a long time and is switched down at time t=0.

   a) What is the final condition for the current i_L?

   b) Find the initial condition(s) of i_L that you would need to have in order to find all the constants in $i_L(t)$. Don' t find $i_L(t)$ or it' s constants, just the initial condition(s).



6. (10 pts) Find the transfer function $H(s) = \frac{V_o(s)}{V_i(s)}$ for this circuit.



Write H(s) in the normal form, as shown below.

$$H(s) = K\cdot\frac{s^n + k_1\cdot s^{n-1} + \ldots + k_{n-1}}{s^m + c_1\cdot s^{m-1} + \ldots + c_{m-1}}$$

Answers

1. a) 2.41V /-22.6° b) 0.5 c) 10.6mW

2. a) 4.8A b) 0.883 c) 203W d) 0.436 e) 2.1A f) 110V g) 53Ω /-28° h) 0.883

3. a) $\frac{d^2}{dt^2} v_L + \frac{1}{C\cdot R}\cdot\frac{d}{dt} v_L + \frac{1}{L\cdot C}\cdot v_L = \frac{d^2}{dt^2} v_S$ b) $0 = s^2 + \frac{1}{C\cdot R}\cdot s + \frac{1}{L\cdot C}$

4. a) $v_X(t) = \left(A + B\cdot e^{-40t} + D\cdot e^{-35\cdot t}\right)\cdot V$ b) overdamped c) A

5. a) 120mA b) $i_L(0) = 50\text{mA}$ $\frac{d}{di} i_{L0} = 3500\cdot\frac{A}{sec}$

6. $$\frac{s^2 + \frac{R_2}{L}\cdot s + \frac{1}{L\cdot C}}{s^2 + \frac{R_1 + R_2}{L}\cdot s + \frac{1}{L\cdot C}}$$

EE 1050 midterm #3

April 17, 2000
Arn Stolp

Name _____
Scores:
Page 1 _____ of a possible 42 points

Page 2 _____ of a possible 32 points

Page 3 _____ of a possible 26 points

Total _____ of a possible 100 points

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