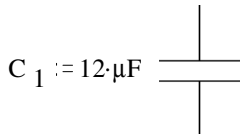
ECE1050/60 Exam 2 given: Spring 05

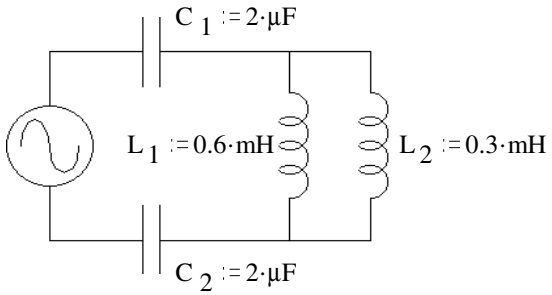
(The space between problems has been removed.)

1. (6 pts) Add another capacitor to the one at left to make an equivalent capacitance of 4μF. You may add it in series or in parallel, but make sure that it is clear to me what your connection is.



$C_{eq} := 4 \cdot \mu F$

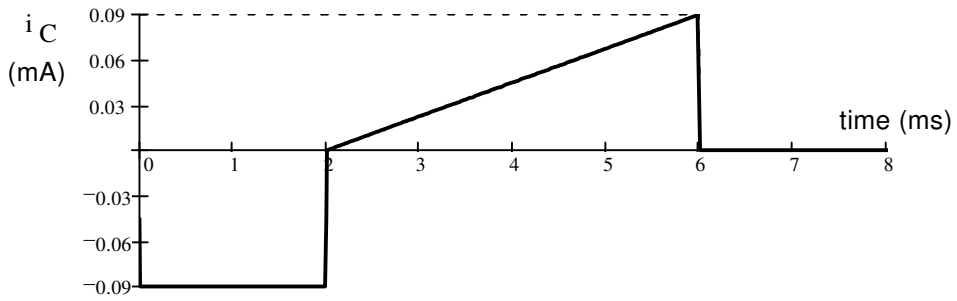
2. (10 pts) Find the resonant frequency (or frequencies) of the circuit (in cycles/sec or Hz).

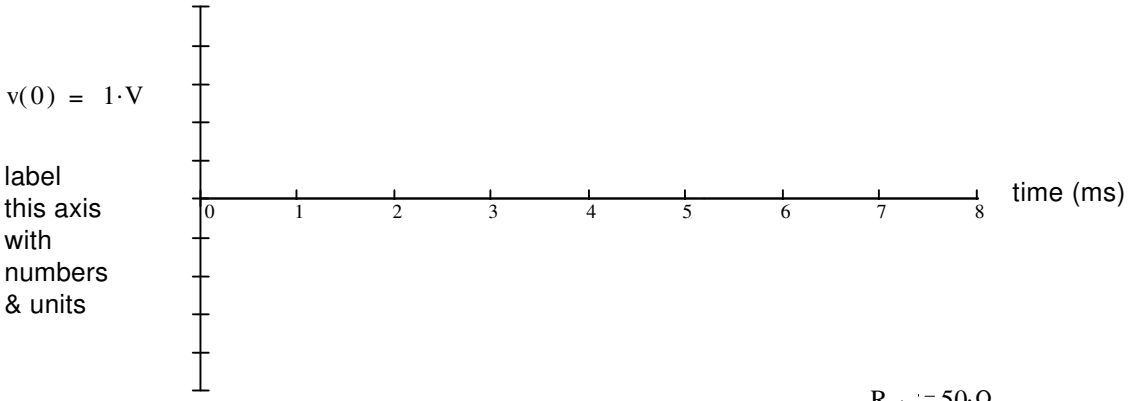


3. (19 pts) The current through a 0.3 μF capacitor is shown below. Make an accurate drawing of the capacitor voltage. Label the y-axis of your graph (I've already done the x-axis). The initial voltage is 1V.

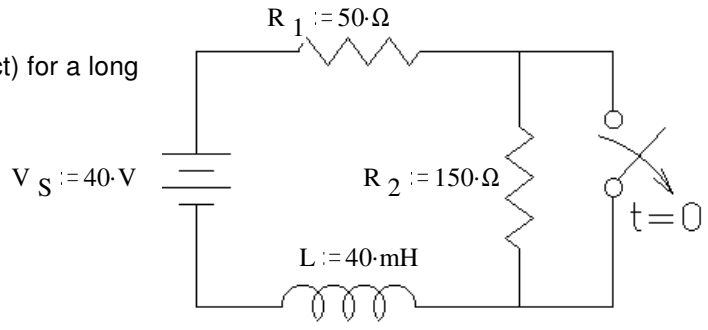
   Note: You will be graded on the accuracy of your plot at 0, 2, 6, and 8 ms, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.

$C := 0.3 \cdot \mu F$ $v(0) = 1 \cdot V$





4. (24 pts) The switch has been closed (making contact) for a long time and is switched open (as shown) at time t = 0.



   a) Find the complete expression for $i_L(t)$.

   b) What is $i_L(0.5ms)$ = ?

   c) At time t = 0.5ms the switch is closed again. Find the complete expression for $i_L(t')$, where t' starts at t = 0.5ms. Be sure to clearly show the time constant.

5. (9 pts) **Subtract** the sinusoidal voltages.

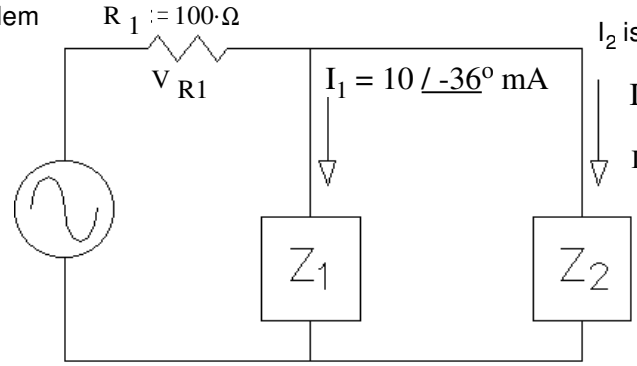
$v_1(t) = 12\cdot V\cdot\cos(377\cdot t + 30)$

$v_2(t) = 8\cdot V\cdot\cos(377\cdot t - 45)$

$v_1(t) - v_2(t) = ?$ Give your answer in time domain form.

6. (20 pts) Note: each part of this problem can be worked out separately.

a) Find Z_1. For partial credit, you must show work and/or intermediate results.



I_2 is given in two forms

$I_2 = 40 / \underline{22}^\circ$ mA

$I_2 = 37.09 + 14.98i$ •mA

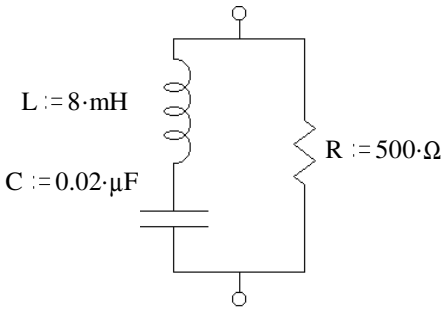
$Z_2 = 120 / \underline{-30}^\circ\ \Omega$

b) Find the voltage across R_1, V_{R1}.

c) $Z_2 = 120 / \underline{-30}^\circ\ \Omega$, To make Z_2 in the simplest way, what part(s) would you need? Just circle the needed part(s), don' t find the values. resistor capacitor inductor power supply current source Thevenin resistor Ideal transformer voltmeter ammeter scope

d) Circle 1: i) I_1 leads I_2 ii) I_1 lags I_2

7. (12 pts) Z_{eq} is the total impedance between the two terminals. Find Z_{eq} in simple polar form (give me numbers). For partial credit, you must show work and/or intermediate results.



f := 8000·Hz $Z_{eq} =$ _____ /_____°

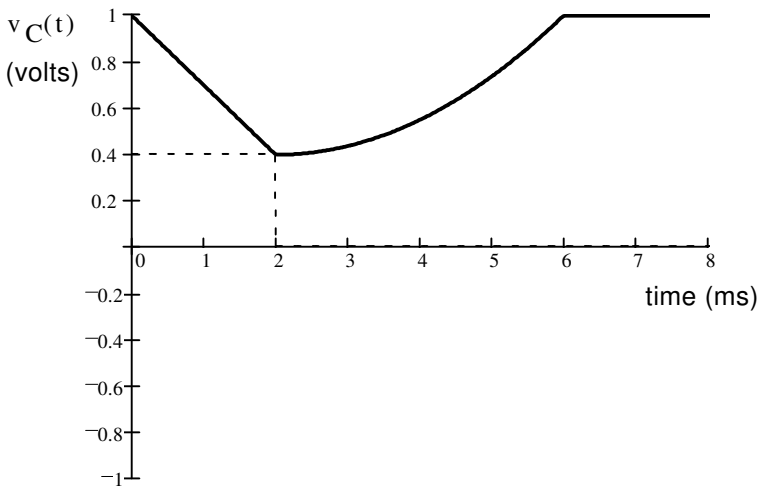
Polar Form

Answers

1. $C_2 = 6\cdot\mu F$ in series

2. $f_o = 11.3\cdot kHz$

3.



4. a) $i_L(t) = 200\cdot mA + 600\cdot mA\cdot e^{-\frac{t}{0.2\cdot ms}}$

b) $i_L(0.5\cdot ms) = 250\cdot mA$

c) $i_L(t') = 800\cdot mA - 550\cdot mA\cdot e^{-\frac{t'}{0.8\cdot ms}}$

5. $v_1(t) - v_2(t) = 12.6\cdot\cos(377\cdot t + 67.9\cdot deg)\cdot V$

6. a) $Z_1 = 480 / \underline{28}^\circ\ \Omega$

b) $V_{R1} := 4.52\cdot V + 0.911\cdot j\cdot V$

$= 4.61 / \underline{11.4}^\circ$ V

c) resistor & capacitor

d) ii, $-36^\circ < 22^\circ$

7. $Z_{eq} = 382.1\Omega / \underline{-40.2}^\circ$

ECE 1050/60 Exam 2

Name _____

Scores:

Page 1&2 _____ of a possible 35 pts

Page 3&4 _____ of a possible 33 pts

Page 5&6 _____ of a possible 32 pts

Total _____ of a possible 100 pts