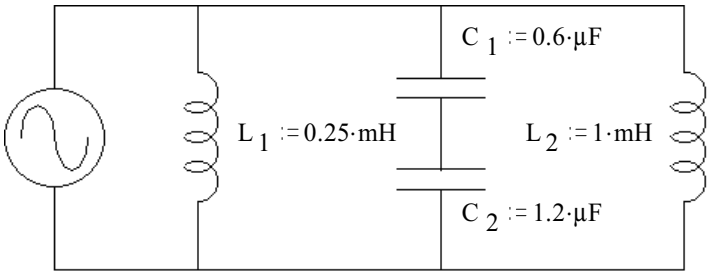
ECE1050/60 Exam 2 given: Fall 03 (The space between problems has been removed.)

1. (9 pts) The voltage across a 0.8 mH inductor is $v_L(t) = 0.6 \cdot V \cdot \cos(20000 \cdot t + 30 \cdot deg)$

   find $i_L(t)$, express it as a cosine wave with the correct phase angle.

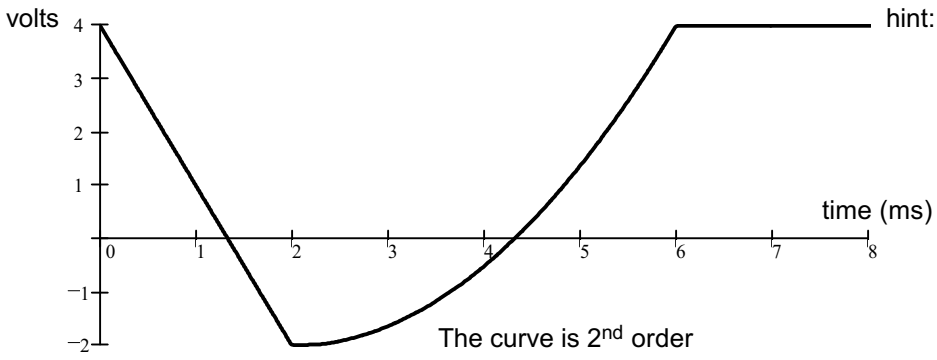
2. (10 pts) Find the resonant frequency (or frequencies) of the circuit (in cycles/sec or Hz).

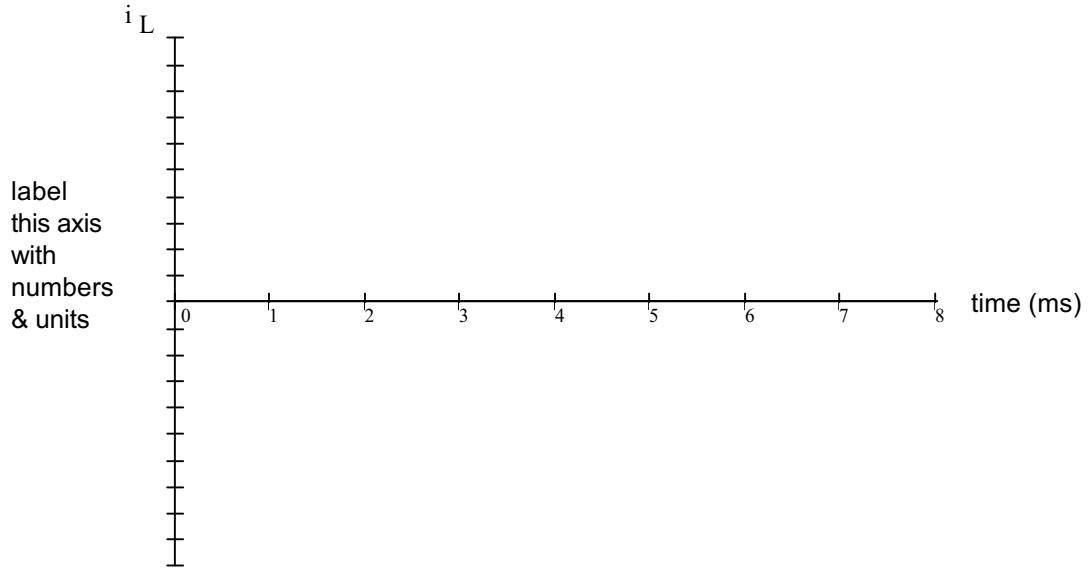


3. (19 pts) The voltage across a 0.03 µF capacitor is shown below. Make an accurate drawing of the capacitor current. Label the y-axis of your graph (I've already done the x-axis).

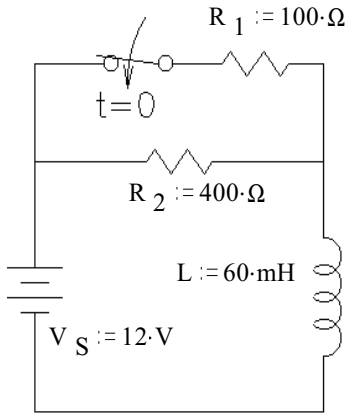
   Note: You will be graded on the accuracy of your plot at 0, 2, 2, and 8 ms, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.

   $C := 0.03 \cdot \mu F$





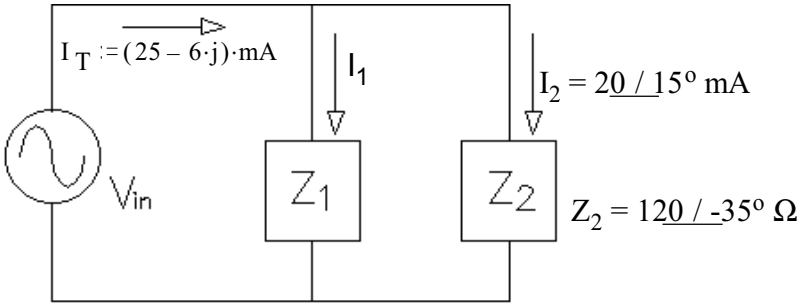
4. (23 pts) a) The switch has been in the open position for a long time and is closed (as shown) at time $t = 0$. Find the initial and final conditions and write the full expression for $i_L(t)$, including all the constants that you find.



b) What is i_L at 0.25ms?

c) At time $t = 0.25\text{ms}$ the switch is opened again. Find the complete expression for $i_L(t')$, where t' starts at $t = 0.25\text{ms}$. Be sure to clearly show the time constant.

5. (21 pts)
a) Find Z_1. For partial credit, you must show work and/or intermediate results.



b) To make Z_1 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

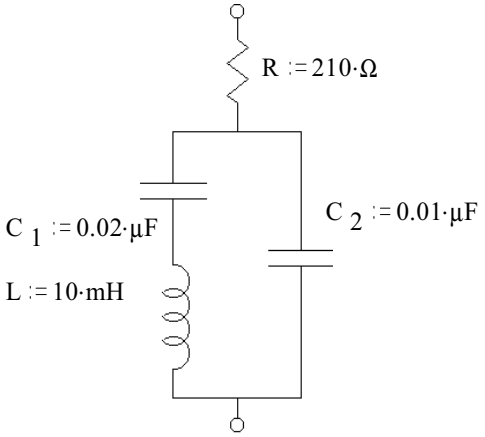
Thevenin resistor Ideal transformer voltmeter ammeter scope

c) Circle 1: i) I_2 leads the source voltage (V_{in}) ii) I_2 lags the source voltage (V_{in})

2. (18 pts) Z_{eq} is the total impedance between the two terminals. Find Z_{eq} in simple polar or rectangular form (give me numbers). For partial credit, you must show work and/or intermediate results.

Hint: First find an expression for Z_{eq} without any numbers, just in terms of j, ω, L, C, & the R's and simplified that (get j's out of denominators).

$f := 10\cdot\text{kHz}$



Answers

1. $i_L(t) = 37.5\cdot\text{mA}\cdot\cos(20000\cdot t - 60\cdot\text{deg})$ 2. $17.8\cdot\text{kHz}$

3. (0ms, -0.09mA), (2ms, -0.09mA), (2ms, 0mA), (6ms, 0.09mA), (6ms, 0mA), (8ms, 0mA)

4.a) $150\cdot\text{mA} - 120\cdot\text{mA}\cdot e^{-\frac{t}{0.75\cdot\text{ms}}}$ b) $64\cdot\text{mA}$

c) $30\cdot\text{mA} + 34\cdot\text{mA}\cdot e^{-\frac{t}{150\cdot\mu\text{s}}}$

5.a) $Z_1 = 191\Omega\,/43.1^o$ b) resistor & inductor c) i)

6. $Z_{eq} = 259\Omega\,/-35.8^o$

ECE 1050/60 Exam 2

Name _____

Scores:

Page 1&2 _____ of a possible 39 pts

Page 3&4 _____ of a possible 43 pts

Page 5 _____ of a possible 18 pts

Total _____ of a possible 100 pts