

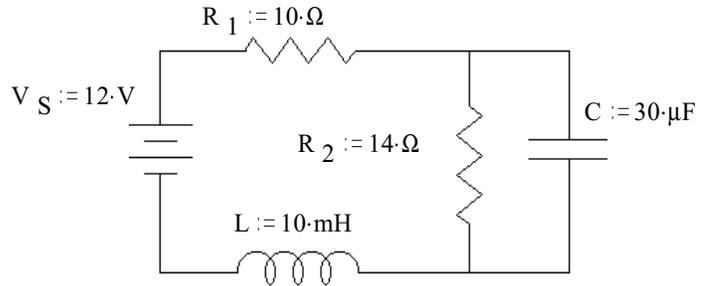
ECE1050/60 Exam 2 given: Fall 04

(The space between problems has been removed.)

1. (9 pts) The following circuit has been connected as shown for a long time.

Find the energy stored in the capacitor and the inductor (2 answers).

Also show the values of the voltage(s) and current(s) necessary to answer this question.

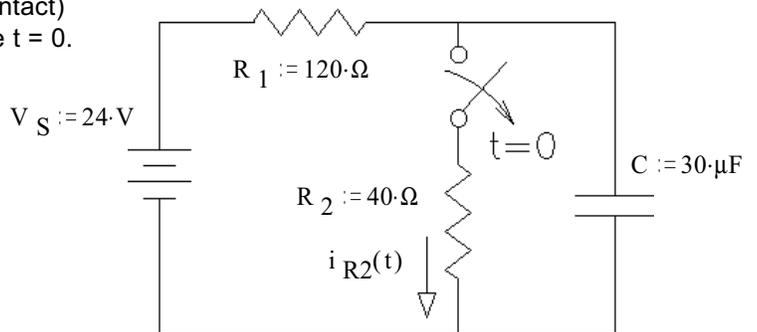


2. (28 pts) The switch has been closed (making contact) for a long time and is opened (as shown) at time $t = 0$.

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

b) What is $v_C(3\text{ms}) = ?$

c) At time $t = 3\text{ms}$ the switch is closed again. Find the complete expression for $i_{R2}(t')$, where t' starts at $t = 3\text{ms}$. Be sure to clearly show the time constant.

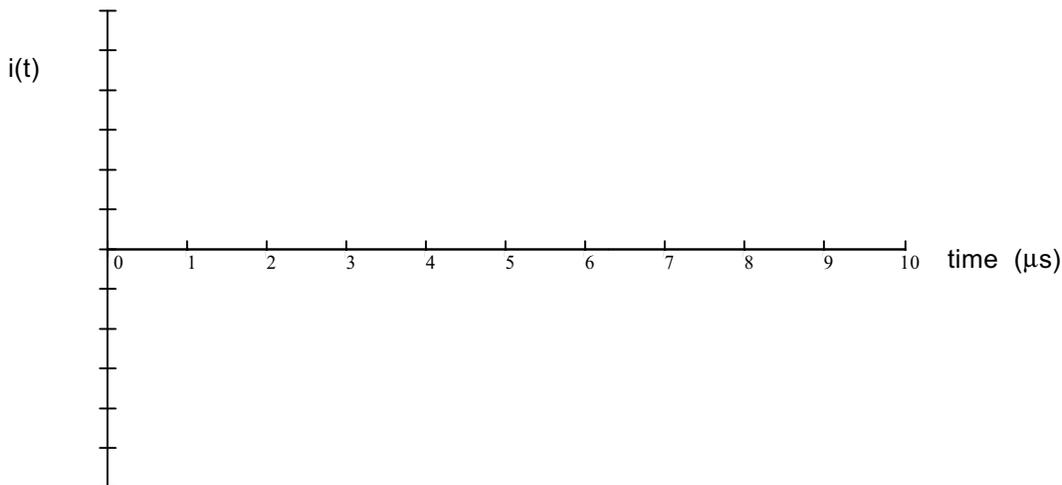
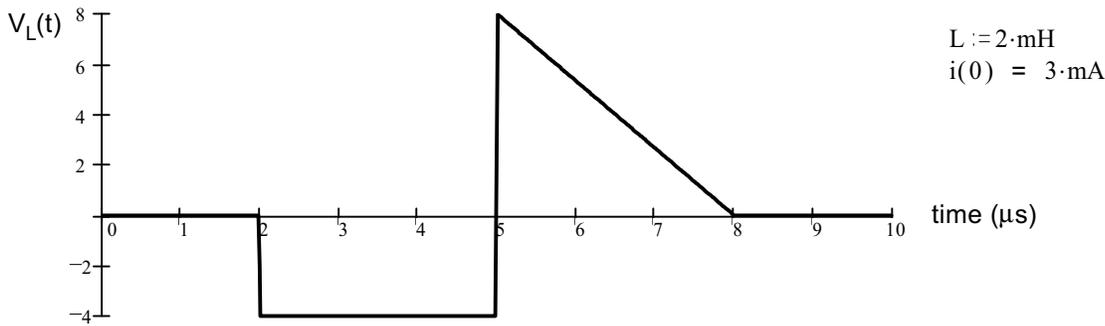


$i_{R2}(t') = ?$

please note that I'm NOT asking for $v_C(t')$, BUT, if you're not sure what to do, go ahead and find $v_C(t')$ and you'll still get most of the points.

3. (18 pts) The voltage across a 2 mH inductor is shown below. Make an accurate drawing of the inductor current, starting at an initial current of 3 mA. Make reasonable assumptions where necessary. Label your graph.

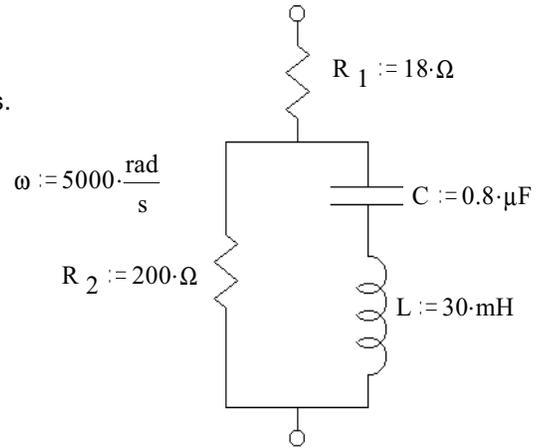
Note: You will be graded on the accuracy of your plot at 0, 2, 5, 8, and 10 ms, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.



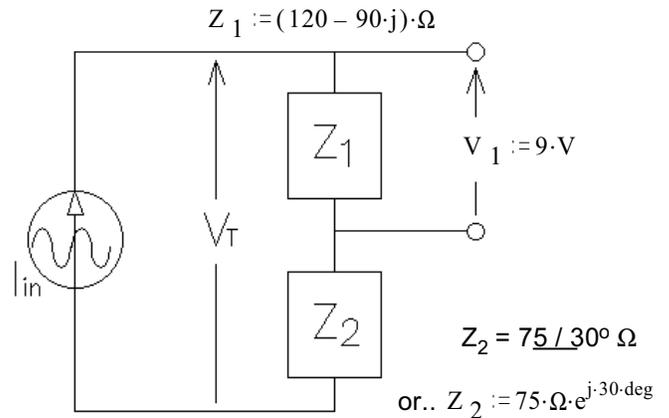
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4. (14 pts) Find Z_{eq} , express in standard rectangular form:
For partial credit, you must show work and/or intermediate results.

$Z_{eq} = \underline{\hspace{2cm}} + \underline{\hspace{2cm}}j$



5. (19 pts) To get partial credit, show each step and each answer along the way.
- Find the AC current source, I_{in} in polar form.
 - Find V_T .
 - Circle 1:
 - The source current leads the source voltage.
 - The source current lags the source voltage.
 - the angle of I_{in} is greater than that of V_T



6. (12 pts.) You need a circuit with the following impedance to a steady-state sinusoidal waveform of 50kHz.

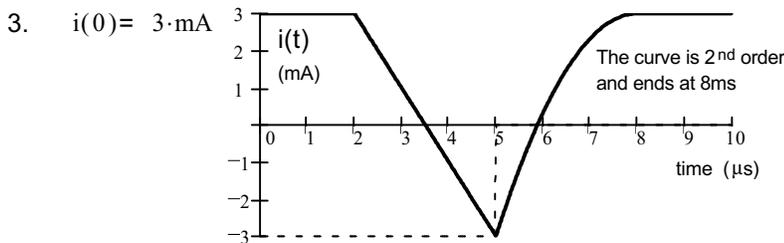
$Z := 2.2 \cdot k\Omega \cdot e^{j30\text{-deg}}$ or $Z = 2.2k\Omega / 30^\circ$ at $f := 50\text{-kHz}$

Draw a **PARALLEL** circuit that has this impedance and find the values of all of the components.

Answers

1. $I_L := 0.5 \cdot A$ $W_L := 1.25 \cdot mJ$ $V_C := 7 \cdot V$ $W_C := 0.735 \cdot mJ$ 2.a) $v_C(t) = 24 \cdot V - 18 \cdot V \cdot e^{-\frac{t}{3.6 \cdot ms}}$

2.b) $16.2 \cdot V$ c) $i_{R2}(t) = 150 \cdot mA + 254.5 \cdot mA \cdot e^{-\frac{t}{0.9 \cdot ms}}$ $v_C(t) = 6 \cdot V + 10.18 \cdot V \cdot e^{-\frac{t}{0.9 \cdot ms}}$



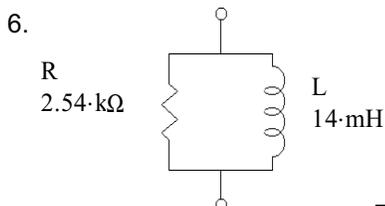
4. $Z_{eq} = 58 \cdot \Omega - 80 \cdot j \cdot \Omega$

5.a) $I_{in} = 60 / 36.87^\circ \text{ mA}$

b) $V_T = 11.54 / 21^\circ \text{ V}$

c) i)

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Name _____

Scores:

Page 1&2 _____ of a possible 37 pts

Page 3&4 _____ of a possible 32 pts

Page 5&6 _____ of a possible 31 pts

Total _____ of a possible 100 pts