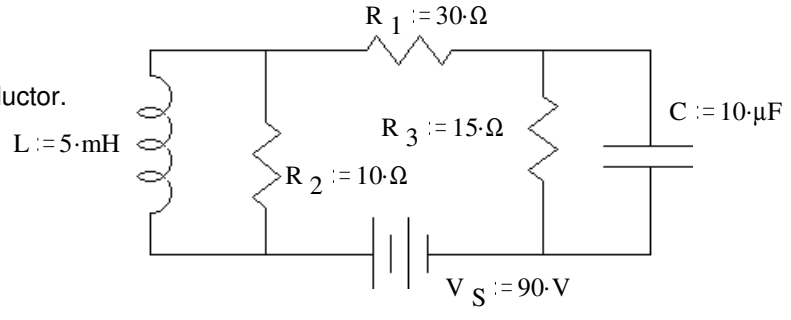
ECE 2210/00 Exam 2 given: Fall 06

(The space between problems has been removed.)

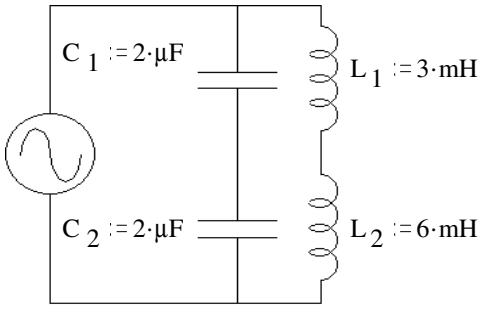
1. (13 pts) The following circuit has been connected as shown for a long time.

   Find the energy stored in the capacitor and the inductor.

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



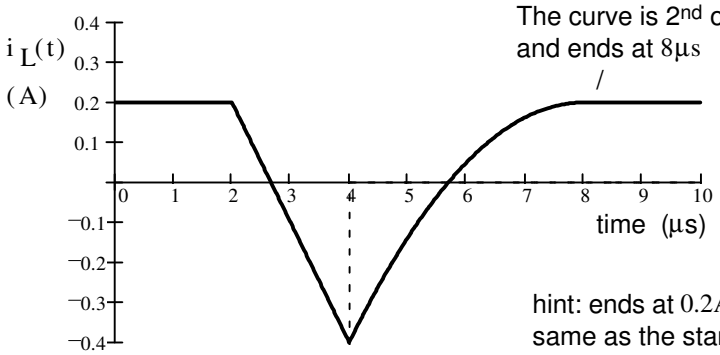
2. (9 pts) Find the resonant frequency (or frequencies) of the circuit shown (in cycles/sec or Hz).

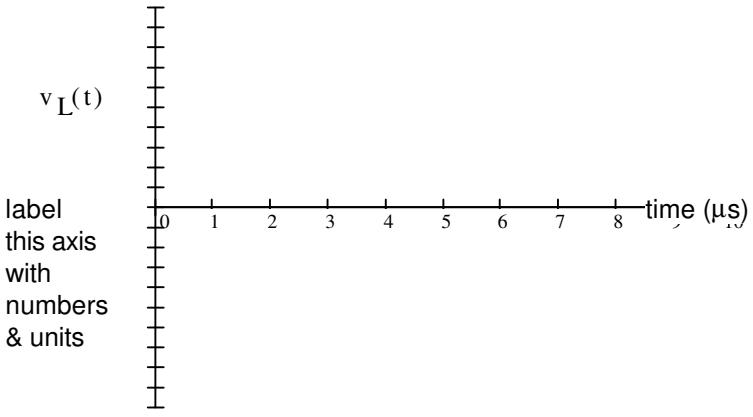


2. (19 pts) The current through a 0.3mH inductor is shown below. Make an accurate drawing of the inductor voltage. Make reasonable assumptions where necessary. Label your graph.

   Note: You will be graded on the accuracy of your plot at 0, 2, 4, 8, and $10\mu\text{s}$, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.

$L := 0.3\cdot\text{mH}$

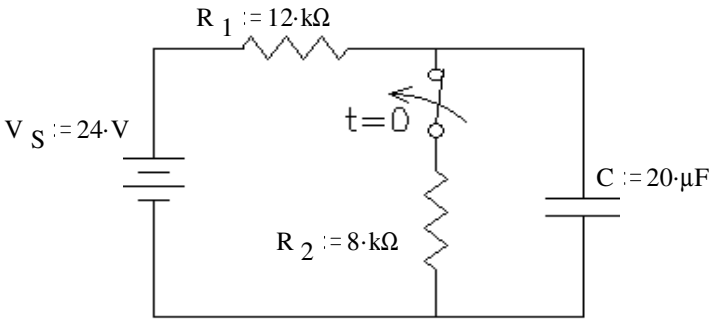




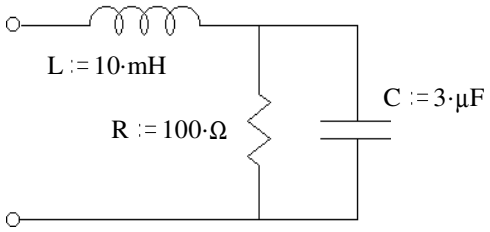
3. (21 pts) The switch has been open for a long time and is closed (as shown) at time $t = 0$.
   a) Find the complete expression for $v_C(t)$.

   b) What is v_C when $t = 2\tau$?

   c) At time $t = 2\tau$ the switch is opened again. Find the complete expression for $v_C(t')$, where t' starts at $t = 2\tau$.
   Be sure to clearly show the time constant.



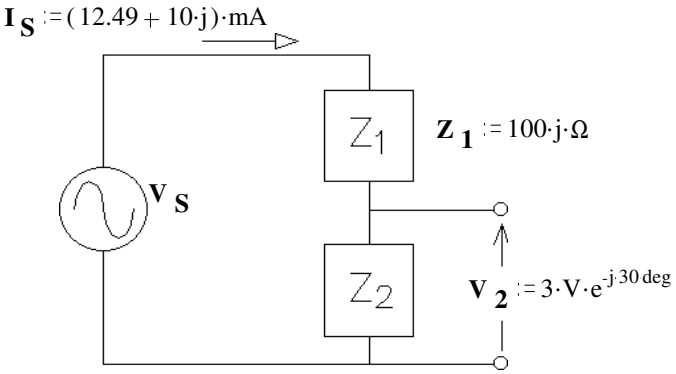
5. (15 pts) $\mathbf{Z_{eq}}$ is the total impedance between the two terminals.
   Find $\mathbf{Z_{eq}}$ in **polar form** (give me numbers).
   For partial credit, you must show work and/or intermediate results.



$f := 500 \cdot Hz$

$\mathbf{Z_{eq}}$ = _____ /_____°

6. (17 pts) For partial credit, you must show work and/or intermediate results.
   a) Find $\mathbf{Z_2}$



   b) Find $\mathbf{V_S}$

   c) Circle 1: i) $\mathbf{I_S}$ leads $\mathbf{V_2}$ ii) $\mathbf{I_S}$ lags $\mathbf{V_2}$

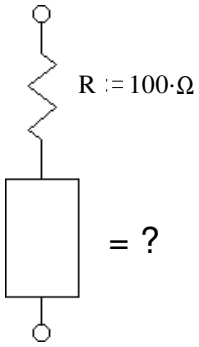
   Why? Show numbers: _____ > _____ _____ < _____

   Or explain by other means:

7. (6 pts) $\mathbf{Z} := |\mathbf{Z}| \cdot e^{j \cdot 30\,deg}$ We don' t know its magnitude, but its phase angle is +30°.
   $\mathbf{Z}$ is made of a 100Ω resistor in series with one other part. What is the part? type and value?

$\omega := 32000 \cdot \frac{rad}{sec}$

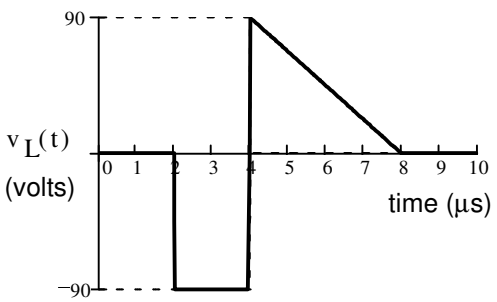
Z =



Answers

1. $2 \cdot A$ $10 \cdot mJ$ $30 \cdot V$ $4.5 \cdot mJ$ 2. $1678 \cdot Hz$

3.



4. a) $9.6 \cdot V + 14.4 \cdot V \cdot e^{-\frac{t}{96 \cdot ms}}$

   b) $11.55 \cdot V$

   c) $24 \cdot V - 12.45 \cdot V \cdot e^{-\frac{t'}{240\,ms}}$

5. $\mathbf{Z_{eq}} = 56.1\Omega \angle -19.3°$

6. a) $\mathbf{Z_2} = 187.5\Omega \angle -68.682°$

   b) $\mathbf{V_S} = 1.62V \angle -8.93°$

   c) i) $\mathbf{I_S}$ leads $\mathbf{V_2}$ $+38.6° < -30°$

   $\mathbf{I_S}$ has positive phase angle, $\mathbf{V_2}$ has negative phase angle

7. $1.8 \cdot mH$ inductor

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Name _____

Scores:

Page 1&2 _____ of a possible 41 pts

Page 3&4 _____ of a possible 36 pts

Page 5&6 _____ of a possible 23 pts

Total _____ of a possible 100 pts