ECE1050/60   Exam 2   given: Spring 03   (The space between problems has been removed.)
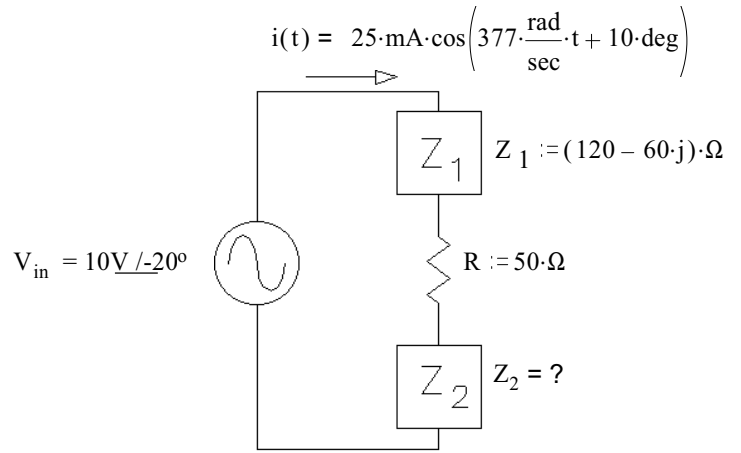
1. (16 pts)

a) Find Z_2. For partial credit, you must show work and/or intermediate results.

b) Circle 1:

  i) The source current leads the source voltage

  ii) The source voltage leads the source current

$$i(t) = 25 \cdot mA \cdot \cos\left(377 \cdot \frac{rad}{sec} \cdot t + 10 \cdot deg\right)$$

$$Z_1 := (120 - 60 \cdot j) \cdot \Omega$$

$$V_{in} = 10V \,\underline{/\text{-}20^o}$$

$$R := 50 \cdot \Omega$$

$$Z_2 = ?$$

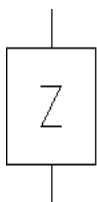**2. (16 pts)** Z_{eq} is the total impedance between the two terminals

a) Find an expressioin for Z_{eq} without any numbers, just in terms of j, ω, L, C, & the Rs.

b) Find Z_{eq} in polar numeric form. For partial credit, you must show work and/or intermediate results.

$$Z_{eq} = \underline{\qquad\qquad /\qquad}{}^o$$

Find numbers in polar form

$$f := 5 \cdot kHz$$

$$L := 10 \cdot mH$$

$$R_1 := 2.2 \cdot k\Omega$$
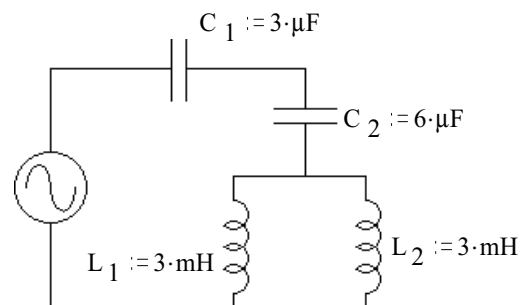
$$R_2 := 1 \cdot k\Omega$$

$$C := 0.02 \cdot \mu F$$
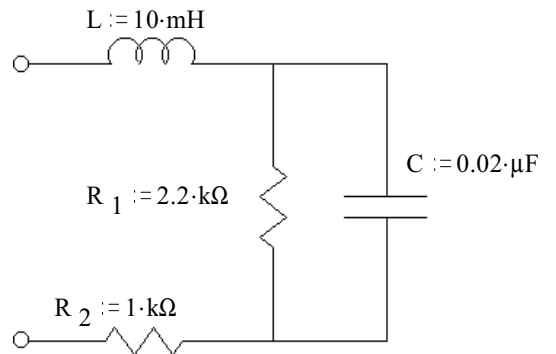
3. (10 pts)

$$Z := (120 - j \cdot 40) \cdot \Omega$$

$$\omega := 1000 \cdot \frac{rad}{sec}$$

Assume Z is two components in series.
Draw the inside of Z and find the value of each component.

4. (9 pts) Find the resonant frequency (or frequencies) of the circuit (in cycles/sec or Hz).

$$C_1 := 3 \cdot \mu F$$

$$C_2 := 6 \cdot \mu F$$

$$L_1 := 3 \cdot mH$$

$$L_2 := 3 \cdot mH$$

ECE1050/60 Exam 2 Spring 03 p2

5. (31 pts) a) The switch has been in the closed position for a long time and is opened (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.
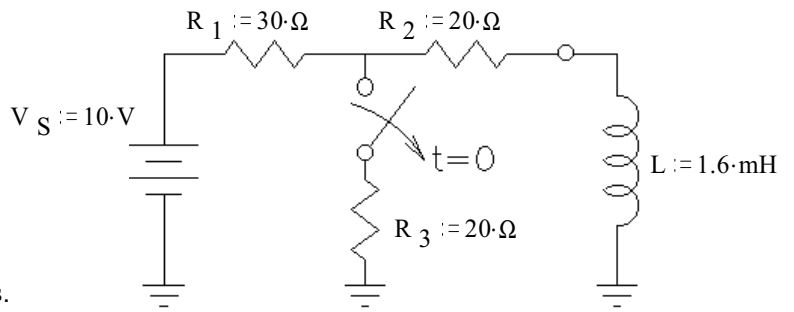
b) What is i_L at $40\mu s$?

c) At time $t = 40\mu s$ the switch is closed again. Find the complete expression for $i_L(t')$, where t' starts at $t = 40\mu s$. Be sure to clearly show the time constant.

$R_1 := 30 \cdot \Omega$ $R_2 := 20 \cdot \Omega$

$V_S := 10 \cdot V$

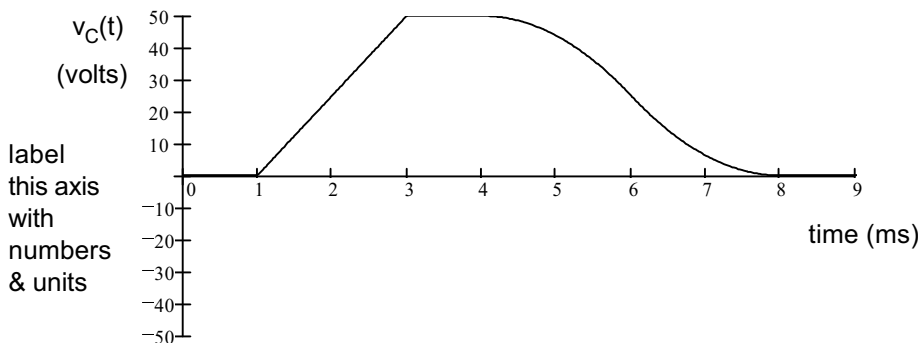$t = 0$ $L := 1.6 \cdot mH$

$R_3 := 20 \cdot \Omega$

6. (18 pts) The current through a $0.4\mu F$ capacitor is shown below. Make an accurate drawing of the capacitor voltage. Make reasonable assumptions where necessary. Label your graph.
Note: You will be graded on the accuracy (volt level) of your plot at 0, 1, 3, 4, 6, 8, and 9 ms, so calculate those values and plot them carefully or label them. Between those points your plot must simply be the correct shape. The initial voltage across the capacitor is 0V.

i(t) (mA) graph

$v_C(0) = 0V$ $C := 0.4 \cdot \mu F$

$v_C(t)$

label this axis with numbers & units

time (ms)
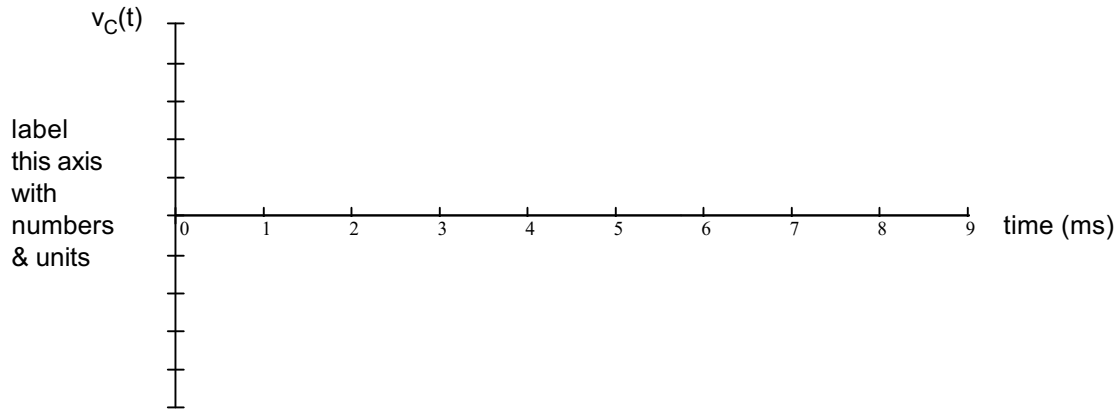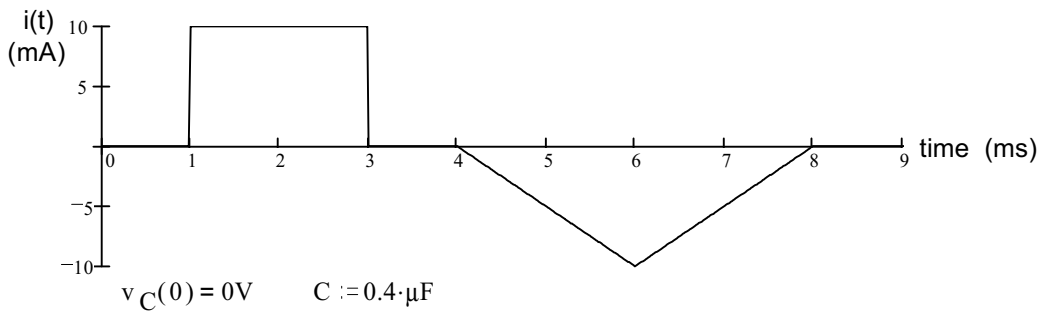
Answers

1.a) $(176.41 - 140 \cdot j) \cdot \Omega$ b) i   2.a) $j \cdot \omega \cdot L + \dfrac{1}{\dfrac{1}{R_1} + j \cdot \omega \cdot C} + R_2$ b) $Z_{eq} = 1902\Omega \underline{/-22.6°}$ 3. $120 \cdot \Omega$

$25 \cdot \mu F$

4. $2.9 \cdot kHz$ 5.a) $200 \cdot mA - 75 \cdot mA \cdot e^{-\frac{t}{32\,\mu s}}$ b) $178.5 \cdot mA$ c) $125 \cdot mA + 53.5 \cdot mA \cdot e^{-\frac{t}{50\,\mu s}}$

$v_C(t)$ (volts) graph

label this axis with numbers & units

time (ms)

ECE 1050/60   Exam 2

Name _____
Scores:
   Page 1&2 _____ of a possible 32 pts

   Page 3&4 _____ of a possible 50 pts

   Page 5   _____ of a possible 18 pts

   Total _____ of a possible 100 pts

ECE1050/60 Exam 2 Spring 03 p2