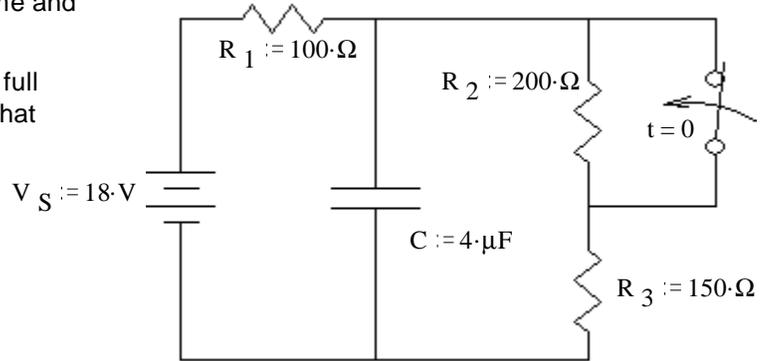


# ECE 2210/00 Exam 2 given: Fall 18

(The space between problems has been removed.)

1. (32 pts) a) The switch has been open for a long time and is closed (as shown) at time  $t = 0$ .

a) Find the initial and final conditions and write the full expression for  $v_C(t)$ , including all the constants that you find.

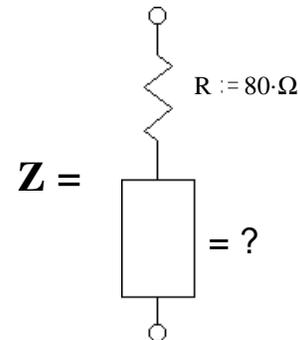


b) What is  $v_C$  when  $t = \tau$ ?  $v_C(\tau) = ?$

c) At time  $t = 1.2\tau$  the switch is opened again. Find the complete expression for  $v_C(t')$ , where  $t'$  starts when the switch opens. Be sure to clearly show the time constant.

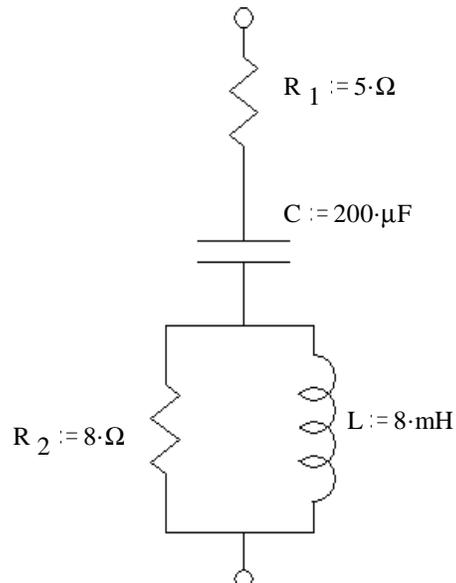
2. (9 pts)  $\mathbf{Z} := |\mathbf{Z}| \cdot e^{j \cdot 30\text{-deg}}$  We don't know its magnitude, but its "phase" angle is  $+30^\circ$ .

$\mathbf{Z}$  is made of a  $80\Omega$  resistor in series with one other part. What is the part? Give type and value.  $\omega := 2000 \cdot \frac{\text{rad}}{\text{sec}}$



3. (18 pts) Find  $\mathbf{Z}_{\text{eq}}$  in simple polar form (give me numbers).

For partial credit, you must show work and/or intermediate results.  $f := 79.577 \cdot \text{Hz}$



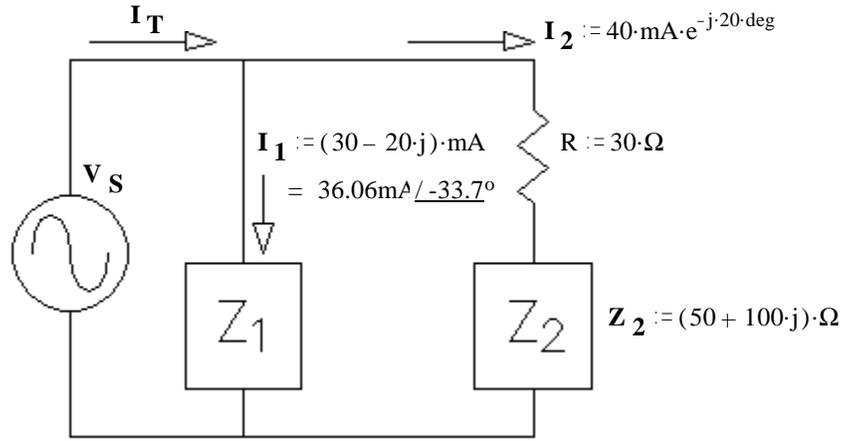
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4. (23 pts) For partial credit, you must show work and/or intermediate results.

a) Find  $V_S$  in polar form.

b) Find  $I_T$

c) Find  $Z_1$



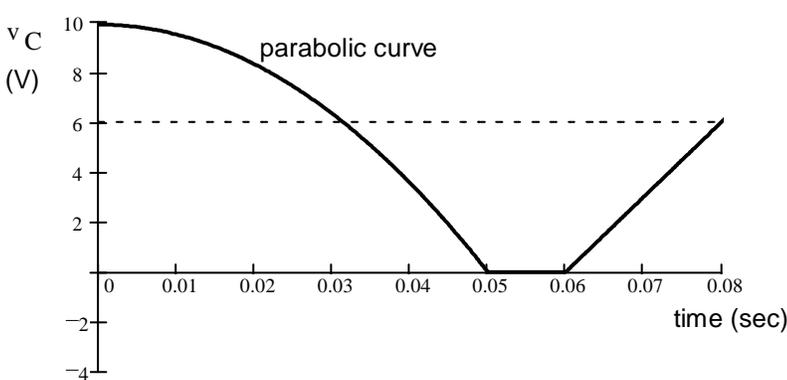
d) Circle 1: i)  $I_1$  lags  $I_2$  ii)  $I_1$  leads  $I_2$  e) By how much? I.E. what is the phase angle between  $I_1$  and  $I_2$ ?

5. 18 pts) The voltage across a capacitor is shown below. Make an accurate drawing of the capacitor current. Make reasonable assumptions where necessary. Label your graph.

Note: You will be graded on the accuracy of your plot at 0, 0.05, 0.06 and 0.08 sec, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.

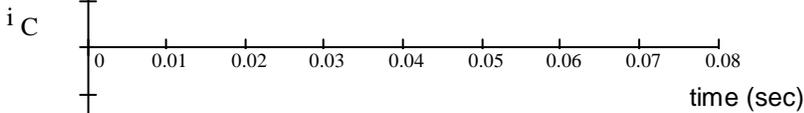
You **MUST SHOW** how you calculate your values starting from the original relationships between voltage and current.

That is: **Start with the interger and/or differential equations for the capacitor!**



$C := 10 \cdot \mu\text{F}$

label this axis with numbers & units



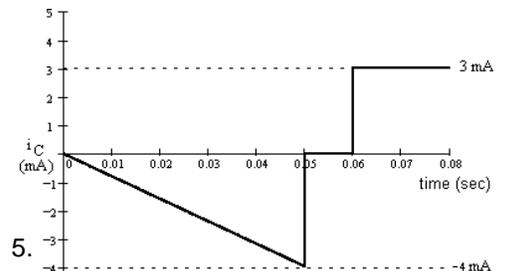
**Answers**

1. a)  $10.8 \cdot \text{V} + 3.2 \cdot \text{V} \cdot e^{-\frac{t}{240 \cdot \mu\text{s}}}$  b)  $11.98 \cdot \text{V}$  c)  $14 \cdot \text{V} - 2.02 \cdot \text{V} \cdot e^{-\frac{t'}{311 \cdot \mu\text{s}}}$  2.  $23.1 \cdot \text{mH}$  Inductor

3.  $9.48 \Omega / -45.9^\circ$  4. a)  $5.12 \text{ V} / 31.34^\circ$  b)  $75.5 \text{ mA} / -26.5^\circ$  c)  $142 \Omega / 65.0^\circ$

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d) i) e)  $13.7 \cdot \text{deg}$



5.