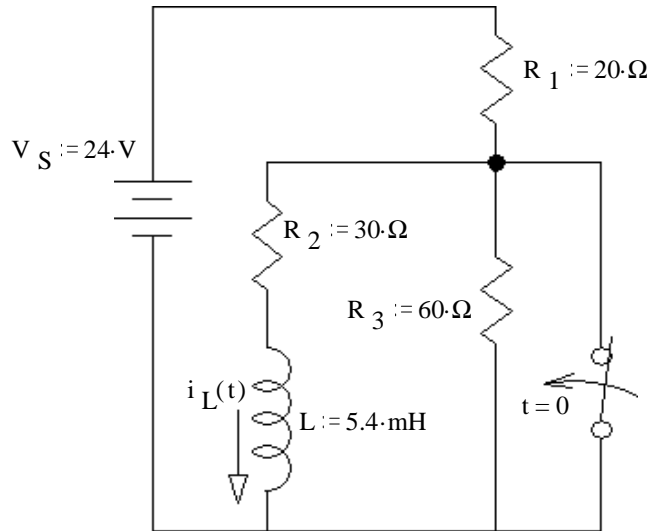# ECE 2210/00 Exam 2 given: Spring 18

(The space between problems has been removed.)

1. (35 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 $i_L(t)$.

$V_S := 24 \cdot V$

$R_1 := 20 \cdot \Omega$

$R_2 := 30 \cdot \Omega$

$R_3 := 60 \cdot \Omega$

$i_L(t)$

$L := 5.4 \cdot mH$

$t = 0$

b) Find i_L at time $t = 1.2\tau$. $i_L(1.2 \cdot \tau) = ?$

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

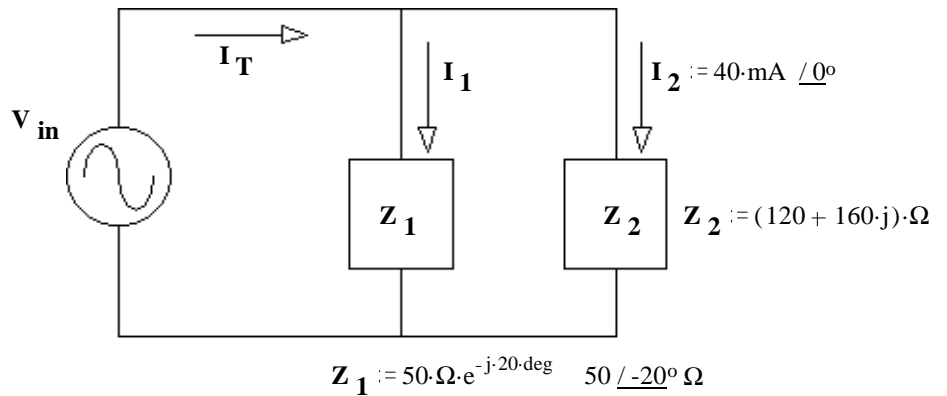2. (20 pts) Find $\mathbf{Z_{eq}}$ in simple polar form (give me numbers).

   For partial credit, you must show
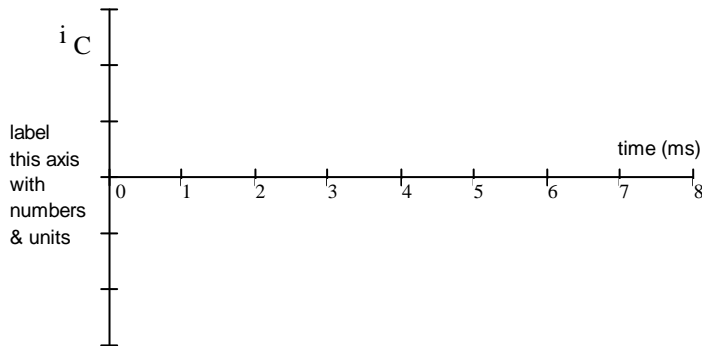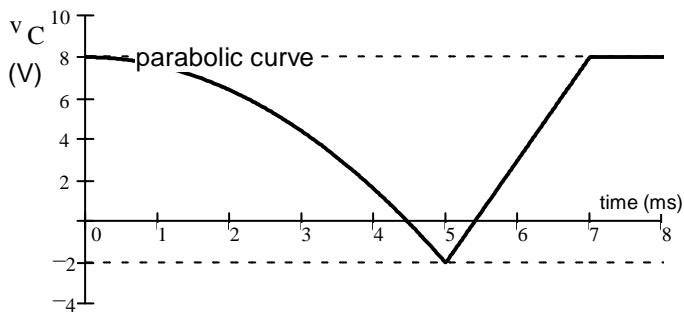   work and/or intermediate results.

   $f = 318.31 \cdot Hz$

$L := 30 \cdot mH$

$R := 50 \cdot \Omega$

$C := 5.0 \cdot \mu F$
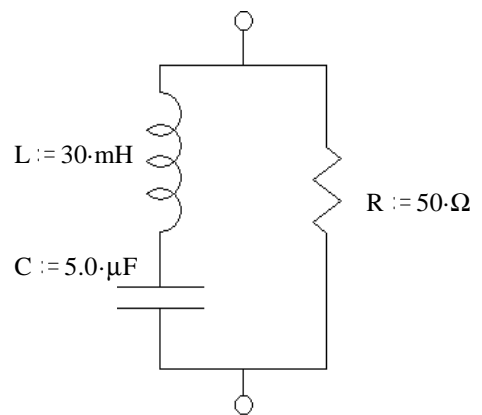
3. (24 pts) a) Find $\mathbf{V_{in}}$ in polar form.

b) Find $\mathbf{I_T}$.

$\mathbf{I_2} := 40 \cdot mA \; \underline{/0^o}$

$\mathbf{V_{in}}$

$\mathbf{Z_1}$

$\mathbf{Z_2}$ $\mathbf{Z_2} := (120 + 160 \cdot j) \cdot \Omega$

$\mathbf{Z_1} := 50 \cdot \Omega \cdot e^{-j \cdot 20 \cdot deg}$ $50 \, \underline{/-20^o} \; \Omega$

c) Circle 1:   i) The source current leads the source voltage   ii) The source voltage leads the source current

d) By how much? I.E. what is the phase angle between the voltage and current?

4. (21 pts) The voltage across a $5 \; \mu F$ 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 $0, 5, 7$ and $8 \; ms$, 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 **integral** and/or **differential** equations for the capacitor! $C := 5 \cdot \mu F$

v_C (V)

parabolic curve

time (ms)

i_C

label this axis with numbers & units

time (ms)

Answers   1. a) $400 \cdot mA \cdot e^{\frac{-t}{180 \cdot \mu s}}$ b) $120.5 \cdot mA$ c) $400 \cdot mA - 279.5 \cdot mA \cdot e^{\frac{-t'}{120 \cdot \mu s}}$

2. $31.2 \, \underline{/-51.3^o} \; \Omega$ 3. a) $8V \, \underline{/53.13^o}$ b) $176mA \, \underline{/60.6^o}$ c) i)   d) $7.43 \cdot deg$

4. start: $(0,0)$, straight line to $(5ms, -20mA)$, straight up to $(5ms, +25mA)$,
flat to $(7ms, +25mA)$, down to $(7ms, 0mA)$, flat to $(8ms, 0mA)$.