Name: _____ (please print)

Signature: _____

ECE 2202 – Quiz 3
February 24, 2022

1. This quiz is closed book, closed notes. You may have one 8.5 x 11" crib sheet.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz. If you are taking it online, you will have an additional 10 minutes to download/print, scan and submit to Blackboard

_____/25

Room for extra work

In the circuit below, the current source is given as follows.

$$i_S(t) = 0 \qquad t < 0$$
$$i_S(t) = 3.5[mA]\, e^{-50[1/s]t} \qquad t \geq 0 \text{ [s]}$$

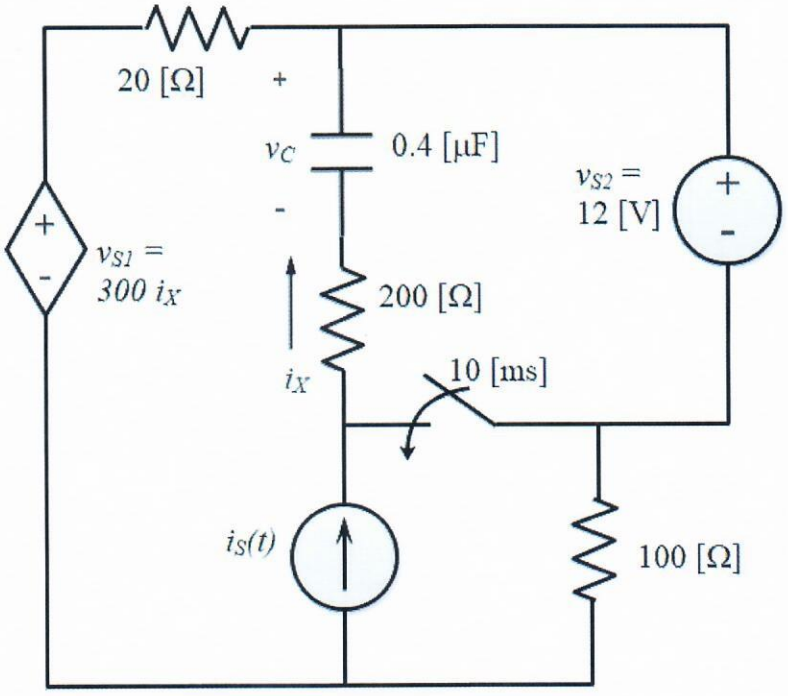
The switch had been open for a long time, and then closed at t = 10 [ms]. The voltage across the capacitor at $t = 0$ is $v_C(0) = 60$ [V].

a) Find v_C (10 [ms]$^+$).

b) Find i_X(10 [ms]$^-$).

c) Find i_X(10 [ms]$^+$).

d) **10 pts. extra credit:** Find the power delivered by v_{S1} at 10[mS]$^+$.



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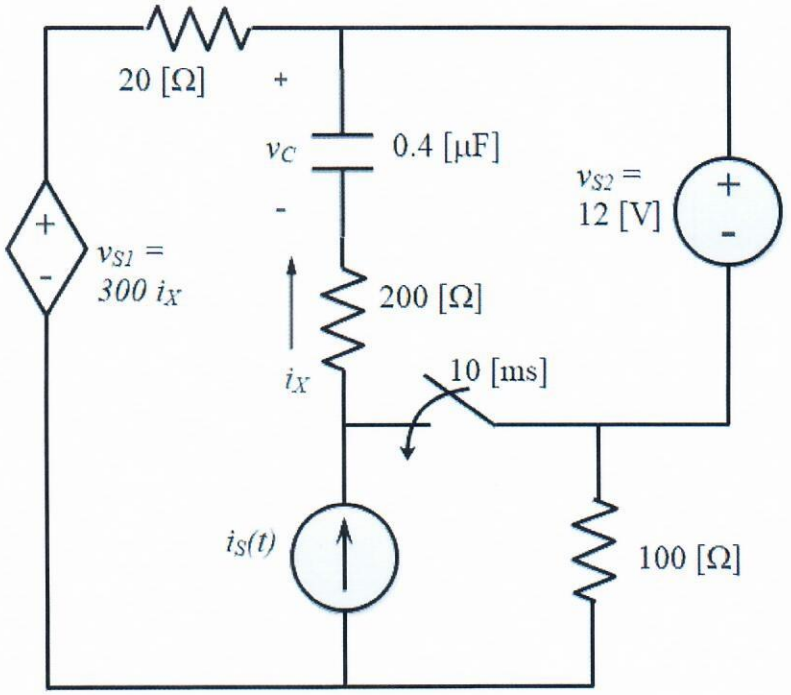


a) For $0 < t < 10$[ms], the capacitor is in series with a current source, so...

$$v_C(10[ms]) = -\frac{1}{0.4\times10^{-6}} \int_0^{0.01[s]} (3.5\times10^{-3})\, e^{-50t}\, dt + 60\ [V]$$

$$= 175\left(e^{-0.5} - 1\right) + 60\ [V] = -8.857\ [V]$$

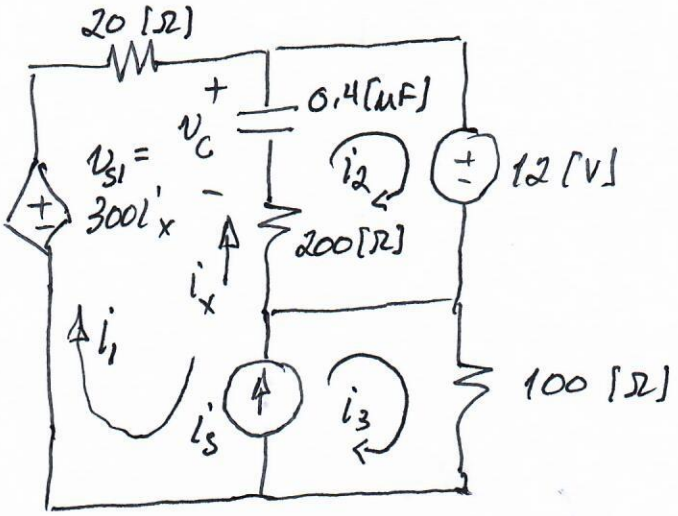
Room for extra work

b) Just before the switch closes, $i_x = i_s$. So...

$$i_x(10[\text{ms}]^-) = i_s(10[\text{ms}]) = (3.5\times10^{-3})\,e^{-50(0.01)} \quad [A]$$

$$= 2.123\times10^{-3} \quad [A]$$

c) At $t = 10[\text{ms}]^+$, the switch is closed. Re-draw:



$P_{del\ by\ v_{s1}} = (300 i_x)\cdot i_1$

$= 11.34$ [W]

KVL: $200\, i_x - v_C(10[\text{ms}]) + 12 = 0$

$$i_x = \frac{v_C(10[\text{ms}]) - 12}{200} = \frac{-8.857 - 12}{200} = -0.1043[A]$$

d) For this we need the current in v_{s1}. We have labeled mesh currents above. Note that $i_s = 2.123\times10^{-3}$ [A].

$200(i_2 - i_1) + 8.857 + 12 = 0$ $\quad i_3 - i_1 = 2.123\times10^{-3}$

$-300 i_x + 20 i_1 - 8.857 + 200(i_1 - i_2) + 100 i_3 = 0$ $\quad i_x = i_2 - i_1$

$i_1 = -0.3625$ [A]

$i_2 = -0.4668$ [A]

$i_3 = -0.3604$ [A]

$i_x = -0.1043$ [A] ← This is consistent with our results above.