Name: _____ (please print)

Signature: _____

ECE 2202 – Quiz 3

October 17, 2024

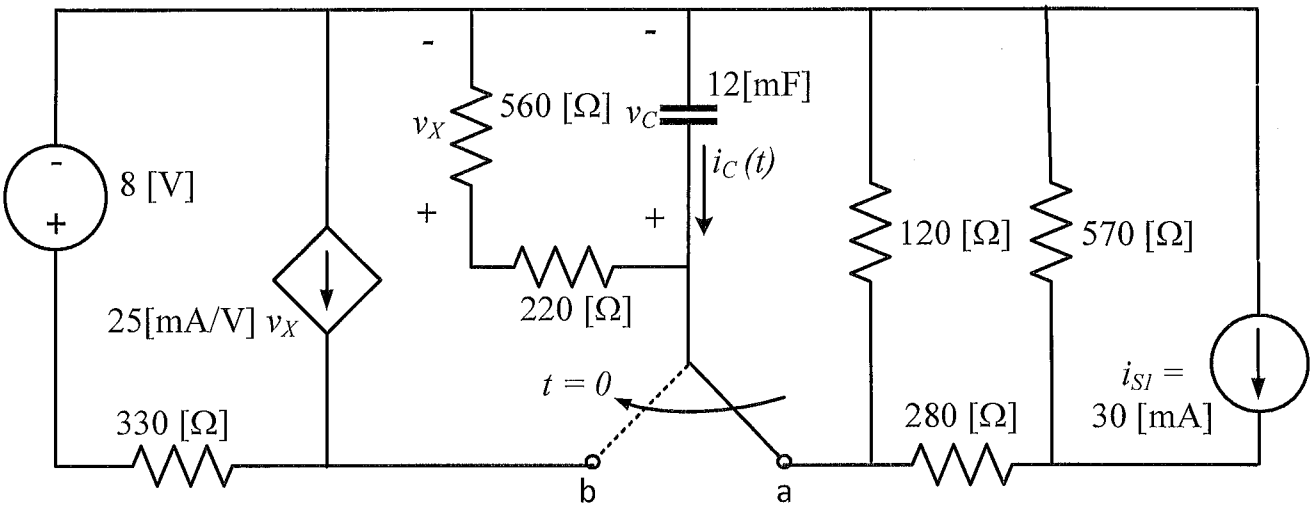
1. This quiz is closed book, closed notes. You may have one 8.5 x 11" crib sheet.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, 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.

_____/25

Room for extra work

In the circuit shown, the switch was in position 'a' for a long time, and moved to position 'b' at t = 0.

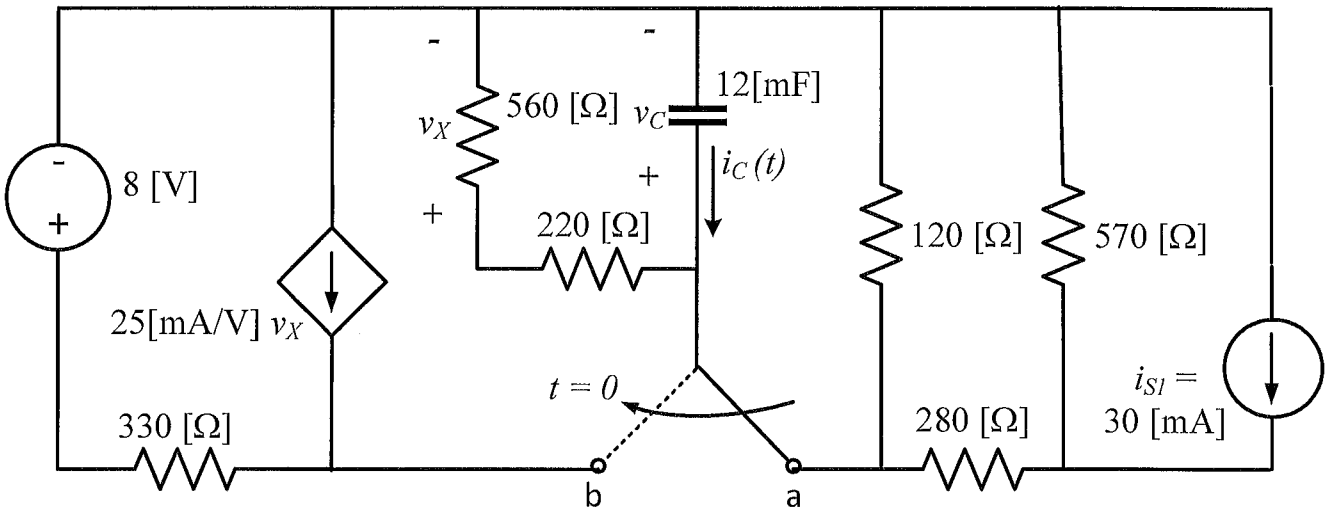
a) Find i_C at $t = 0.2$ [s].
b) Find $v_C(t)$ for $t \geq 0$.



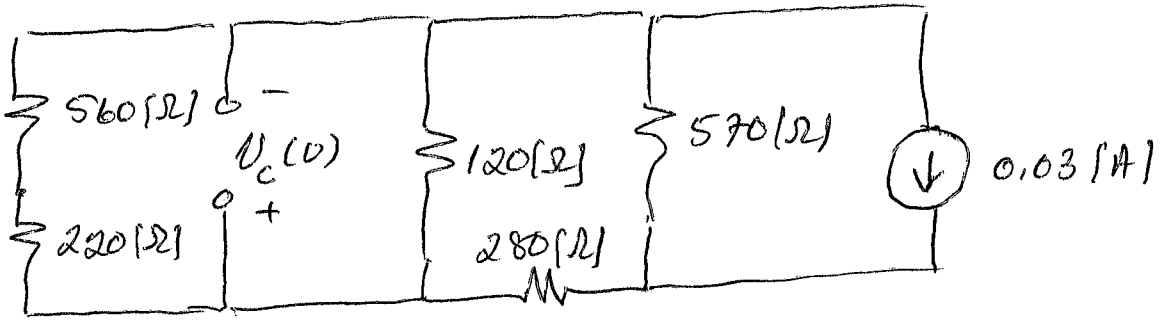
Room for extra work

In the circuit shown, the switch was in position 'a' for a long time, and moved to position 'b' at t = 0.

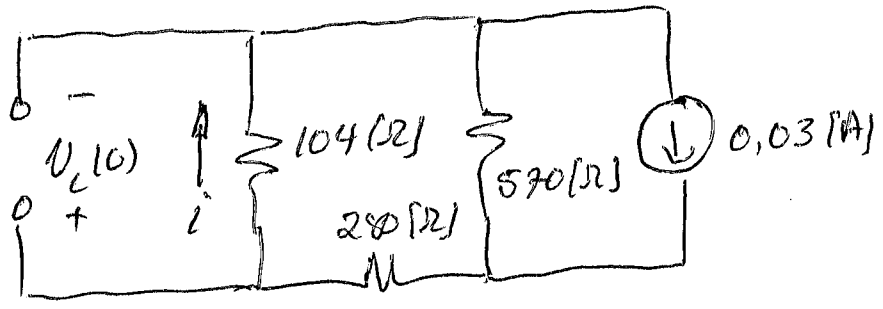
a) Find i_C at $t = 0.2$ [s].
b) Find $v_C(t)$ for $t \geq 0$.



Draw for $t<0$ and C → open ckt in steady state.



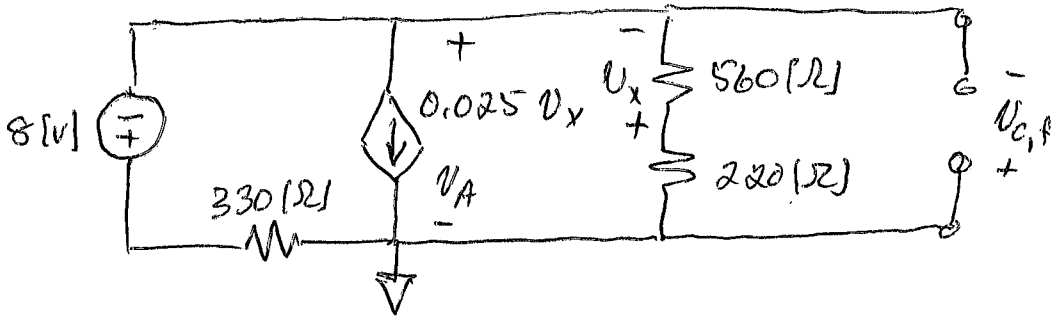
we can simplify: $(560\,[\Omega] + 220\,[\Omega]) \,//\, 120\,[\Omega] = 104\,[\Omega]$



$$V_c(0) = 104 \cdot i = 104 \cdot (0.03) \cdot \frac{570}{570 + 280 + 104} = 1.8642\ [V]$$

Room for extra work

Draw for $t>0$ and find $v_{c,f}$ $\Rightarrow$ C $\rightarrow$ open circuit



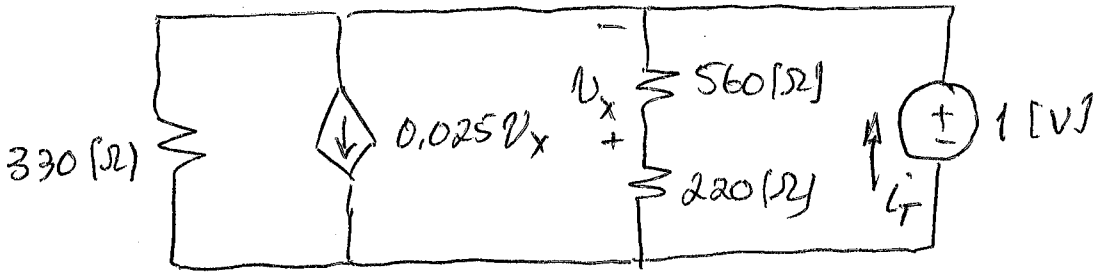
$$\frac{v_A + 8}{330} + \frac{v_A}{560+220} + 0.025\, v_x$$

$$v_x = -v_A \frac{560}{560+220}$$

$$\Rightarrow \quad v_A = 1.7778\ [V], \qquad v_x = -1.2764\ [V]$$

$$v_{c,f} = -v_A = -1.7778\ [V].$$

Find R_{TH}



$$i_T = \frac{1}{560+220} + \frac{1}{330} + 0.025\, v_x \qquad v_x = -1 \cdot \frac{560}{560+220}$$

$$i_T = -0.0136\ [A] \Rightarrow R_{TH} = -73.333\ [\Omega]$$

$$\Rightarrow \tau_c = -0.88\ [s]$$

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Room for extra work

$$v_c(t) = v_{c,f} + (v_c(0) - v_{c,f}) e^{-t/\tau_c}$$

$$= -1.778 + (1.8642 - (-1.778)) e^{t/0.88\,[s]} \quad [V] \quad t \geq 0$$

b) $$\boxed{v_c(t) = -1.778 + 3.642\, e^{t/0.88\,[s]} \quad [V] \quad t \geq 0}$$

a) $$i_c(t) = -C \frac{dv_c(t)}{dt} = -0.012(3.642) \frac{1}{0.88} e^{t/0.88}$$

$$= -0.0497\,[A]\, e^{t/0.88\,[s]} \quad t > 0$$

$$\boxed{i_c(t = 0.2\,[s]) = -0.0497 e^{0.2/0.88}}$$

$$= -0.0623\,[A]$$