Name: _____ (please print)

Signature: _____

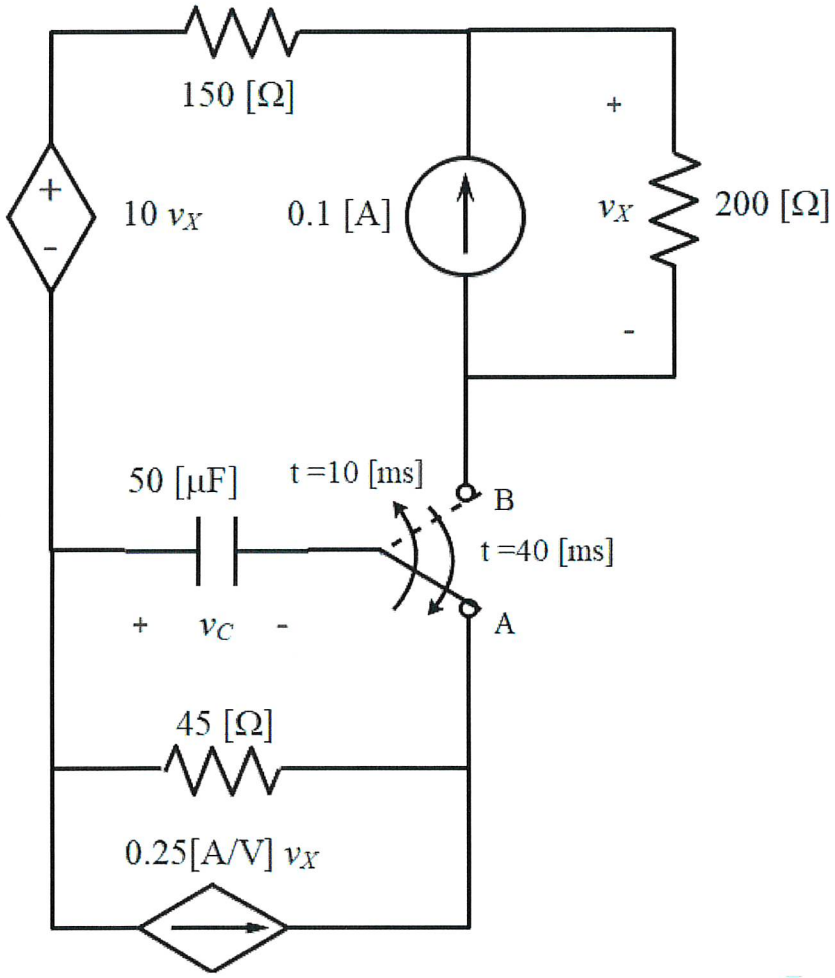
ECE 2202 – Quiz 4
March 10, 2022

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.

_____/25

In the circuit below, the switch was in position A for a long time, and then moved to B at t = 10 [ms]. At t = 40 [ms] it returned to position A.

a) Find v_C (t) for 40 [ms] ≥ t ≥ 10 [ms].
b) Find the value of v_C a long time after the switch moves back to A.



Room for extra work

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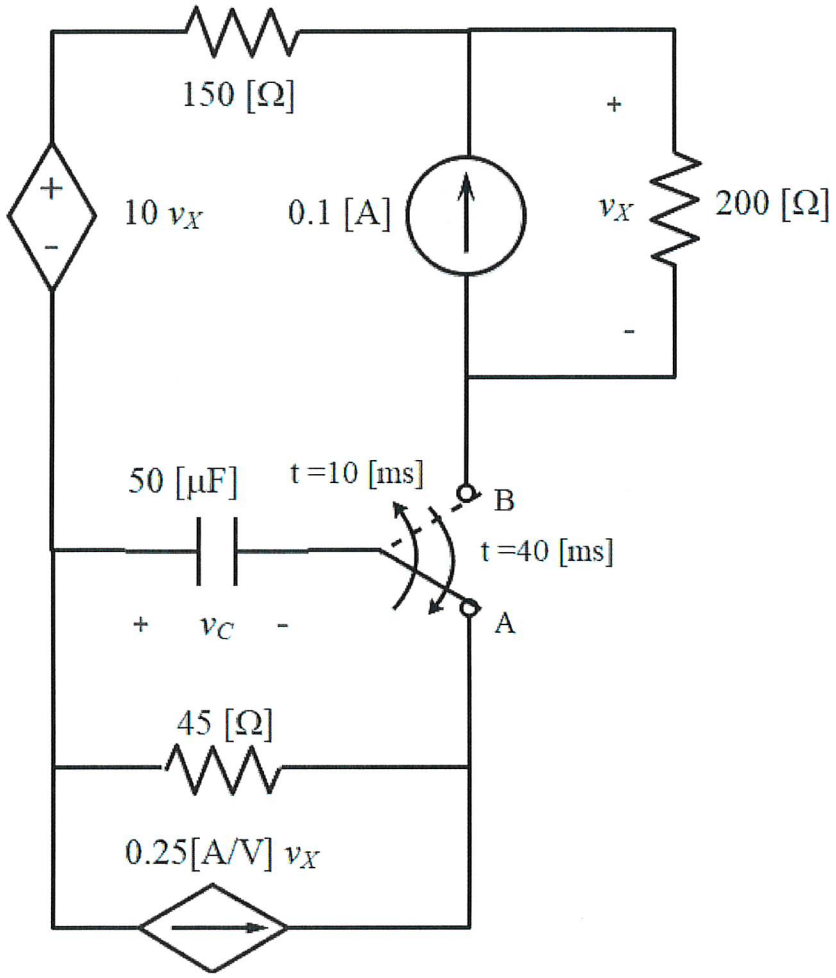


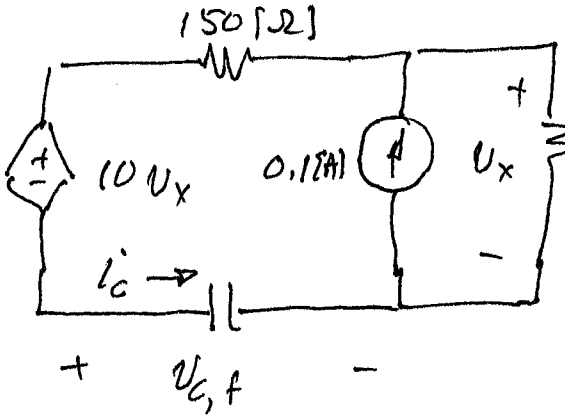
a) we need an initial condition for $t < 10$ [ms]. With the switch at A, we have

$$v_x = 0.1(200) = 20 \text{ [V]}$$

$$v_c = -0.25\left[\frac{A}{V}\right] v_x \cdot 45 = -225 \text{ [V]}$$

Room for extra work

For $10 < t < 40$ [ms] we need $v_{c,f}$ and τ_c.

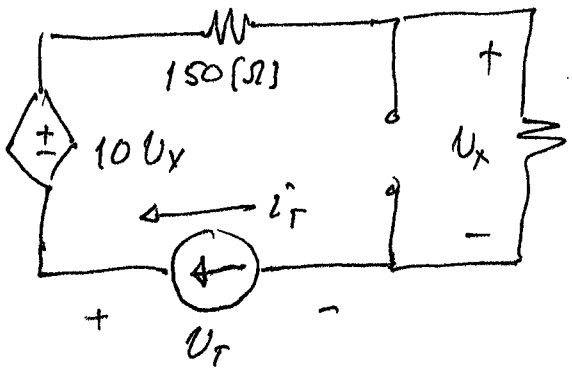


C → open circuit ⇒ $i_c = 0$

$v_{c,f} - v_x + 10 v_x = 0$ $\quad v_x = 20$ [V]

$v_{c,f} = -9 v_x = -180$ [V]

R_{TH}:



$v_x = 200 i_T$

b) A long time after the switch returns to A, we will be back in steady state, so

$v_c(\infty) = -225$ [V] $\quad t \to \infty$

$-v_T - 10 v_x + 150 i_T + v_x = 0$

$v_T = -10(200 i_T) + 150 i_T + 200 i_T = -1650 i_T$

$v_T / i_T = R_{TH} = -1650$ [Ω] $\quad \tau_c = R_{TH} C = (-1650)(50 \times 10^{-6}) = -82.5$ [ms]

$\therefore v_c(t) = -180 + (-2250 - (-180)) e^{+(t-10)/82.5}$

$= -180 - 2070 e^{+(t-10)/82.5}$ [V] $\quad 10 \le t \le 40$ [ms]