Name: SOLUTIONS (please print)

Signature: _____

ECE 2202 – Quiz 2

September 19, 2023

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.

_____/20

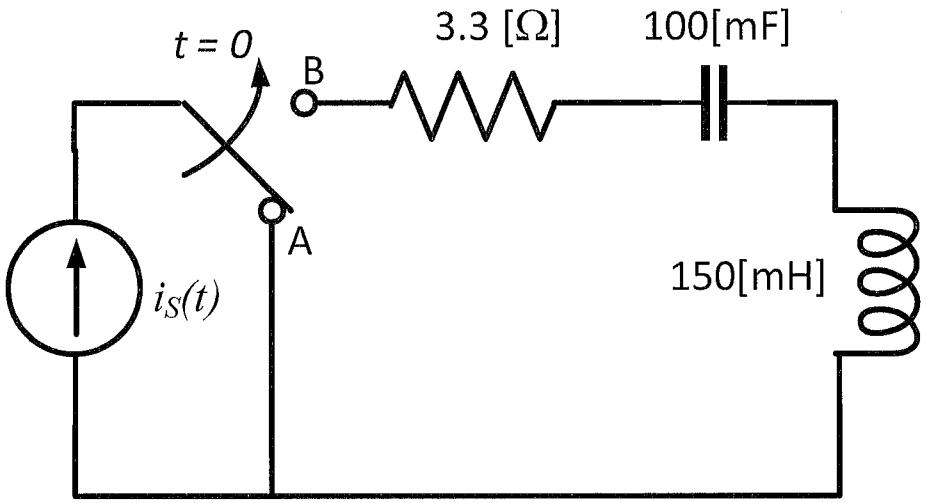
Room for extra work

Version 1

In the circuit shown below, the switch moved from position 'A' to position 'B' instantaneously at t = 0. At t = 0, no energy was stored in the capacitor, and no energy was stored in the inductor. The expression for $i_S(t)$ is given below.

$$i_S(t) = 3\left[\frac{A}{s^3}\right]t^3 \qquad t \geq 0$$

Find the power delivered by the current source at t = 0.5[s].



VERSION 2

In the circuit shown below, the switch moved from position 'A' to position 'B' instantaneously at t = 0. At t = 0, no energy was stored in the capacitor, and no energy was stored in the inductor. The expression for $i_S(t)$ is given below.

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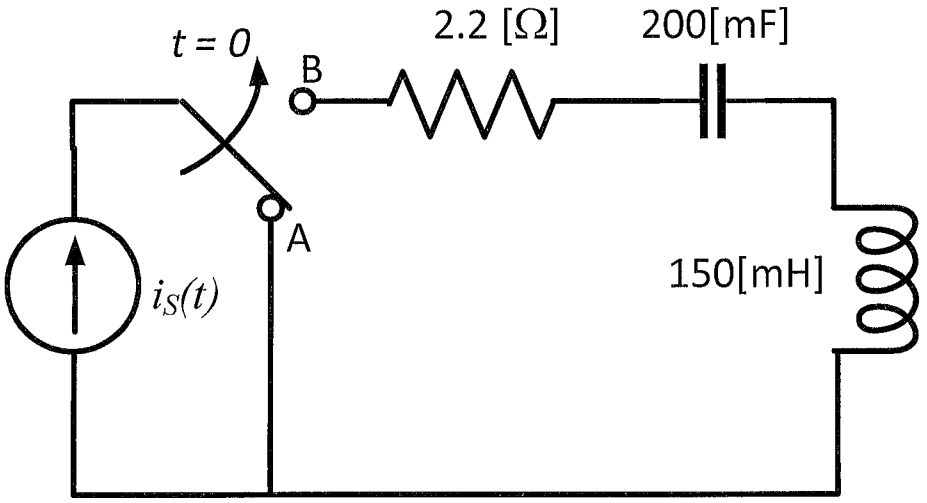

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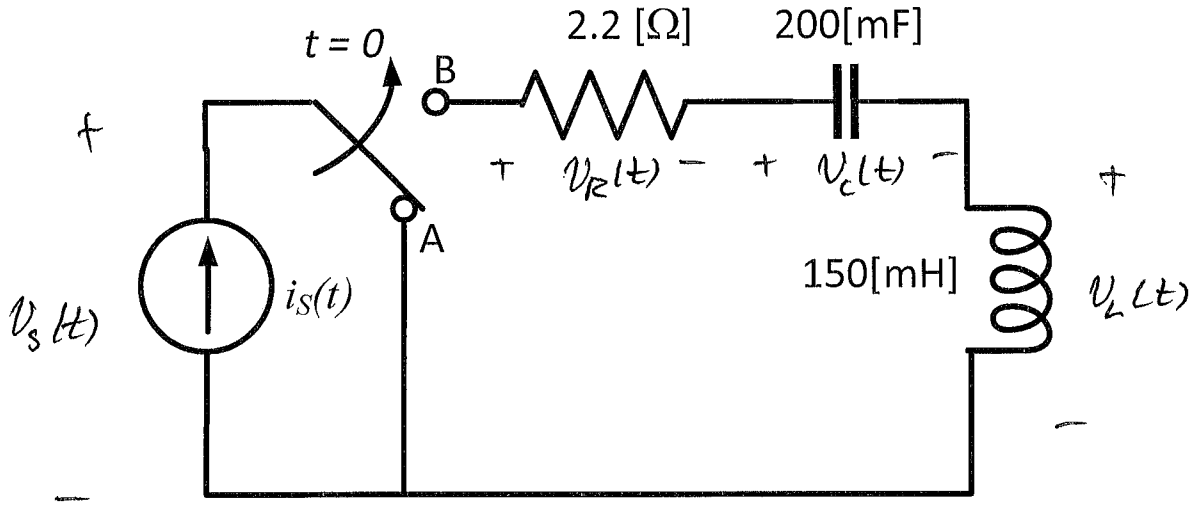

$$v_s(t) = v_R(t) + v_c(t) + v_L(t)$$

$$v_R(t) = 2.2\,[\Omega] \cdot 3\left[\frac{A}{s^3}\right]t^3 = 6.6\left[\frac{V}{s^3}\right]t^3$$

$$v_c(t) = \frac{1}{C}\int_0^t i_s(t)\,dt + v_c(0)$$

$$= \frac{1}{0.2\,[F]}\cdot\int_0^t 3\left[\frac{A}{s^3}\right]t^3\,dt + 0 = \frac{15}{4}\left[\frac{A}{F\cdot s^3}\right]t^4$$

$$\hookrightarrow \left[\frac{V}{s^4}\right]$$

$$v_L(t) = L\frac{di_L(t)}{dt} = 0.15\,[H]\cdot 3\cdot 3\left[\frac{A}{s^3}\right]t^2 = 1.35\left[\frac{V}{s^2}\right]t^2$$

Room for extra work

We have explicitly indicated units, which was not necessary for full credit. But it shows that with t in [s], each term has units of [V].

$$v_s(t) = 6.6\left[\frac{V}{s^3}\right]t^3 + 3.75\left[\frac{V}{s^4}\right]t^4 + 1.35\left[\frac{V}{s^2}\right]t^2$$

At $t = 0.5$ [s], $v_s(t) \rightarrow v_s(0.5\,[s]) = 1.397$ [V]

$i_s(t) \rightarrow i_s(0.5\,[s]) = 0.375$ [A]

$\therefore$ $P_{del\ by\ i_s}(0.5\,[s]) = (1.397\,[V])(0.375\,[A]) = 0.5239$ [W]

A second version of the quiz had $R = 3.3$ [Ω], $C = 100$ [mA], for which

$v_s(0.5\,[s]) = 2.0438$ [V]

$P_{del\ by\ i_s}(0.5\,[s]) = 0.7664$ [W]