Name: _____ March 6, 2017

UTEP ID: _____ EE 2351 Test 1 Spring 2017

Instructions:

a. **Please keep your cell phone stored in your bag or pocket. No cellphone access during the exam. If you are found using your cellphone, you will be asked to leave the room and will receive a grade of 0 in the test.**

b. **You cannot talk to your classmates during the exam. If you talk to your classmates during the exam, you will be asked to leave the room and will receive a grade of 0 in the test.**

c. **This is a closed book, closed notes, no computer exam. You are allowed a single sheet of paper with formulas. You will need to hand in the sheet with your answers to the exam. You will get it back after grading.**

d. **Put the proper units and prefixes with your answers and use the appropriate sign conventions.**

e. **Show all work. Explicitly state in your answer when the calculator is used to get the roots of a polynomial or to solve a system of equations.**

f. **Write the answer(s) to each question on the space provided. Do all of your work on the pages provided. No scrap paper is permitted. Use the front side of the page to write your answer and calculations if possible. However, you may also use the backs if you run out of space.**

g. **No bathroom breaks during the exam.**

h. **Please turn your papers stapled together <u>with this sheet on top</u>.**

By signing this exam, you agree that the work presented here represents only your effort.

Signature: _____

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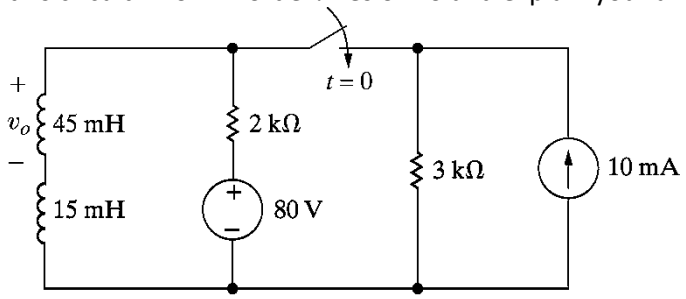
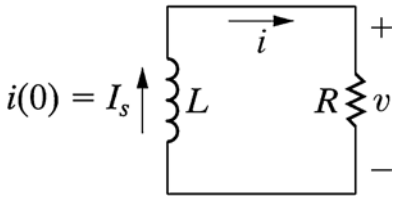
Short Answer Questions (20 pts)

1. Circuit Order: Is this circuit 1st or 2nd order? Yes or no and explain your answer.



2. Time Constants in First-Order Circuits: For the circuit shown below, we showed in class that $i(t) = I_s e^{-t/\tau}$, for t≥0. Approximately, how many time constants, τ, does is take for the inductor current to be at 2% of the initial current value? Approximately, how many time constants does it take for the resistor to dissipate 98% percent of the initial energy stored in the inductor?



3. RLC Damping: In a series RLC circuit, for fixed values of L and C, how does changing the value of R changes the damping of the circuit?

4. Continuity of the Capacitor Voltage: Give a short explanation of why the voltage across a capacitor cannot change instantaneously or equivalently it is continuous.

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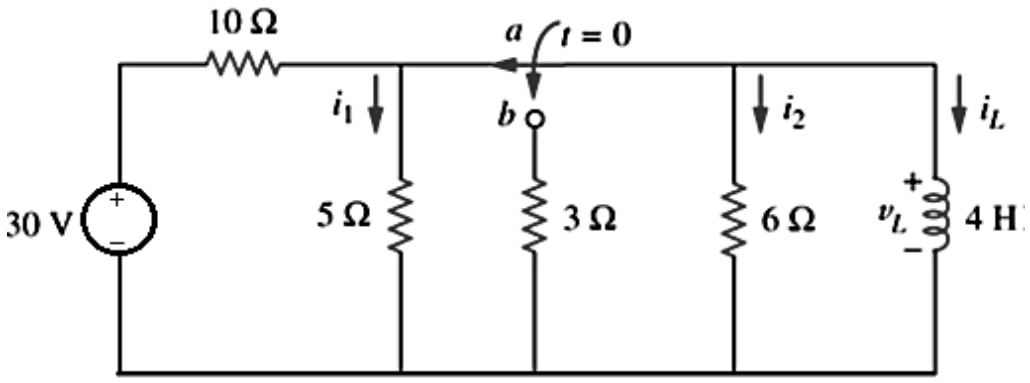
5. For the circuit shown below, the switch is in position **a** for a long time before changing to position **b** at t=0. **(40 points)**



a. Find $i_2(0^-)$ and $i_2(0^+)$.
b. Is $i_2(0^-) = i_2(0^+)$? Answer yes or no and explain your answer.
c. Determine the time constant of the circuit for t>0.
d. Write the expression for $i_L(t)$ for t≥0.
e. Find the energy stored in the 4H inductor at t=0?
f. What percentage of the initial energy stored in the inductor is dissipated in the 6 Ω resistor?

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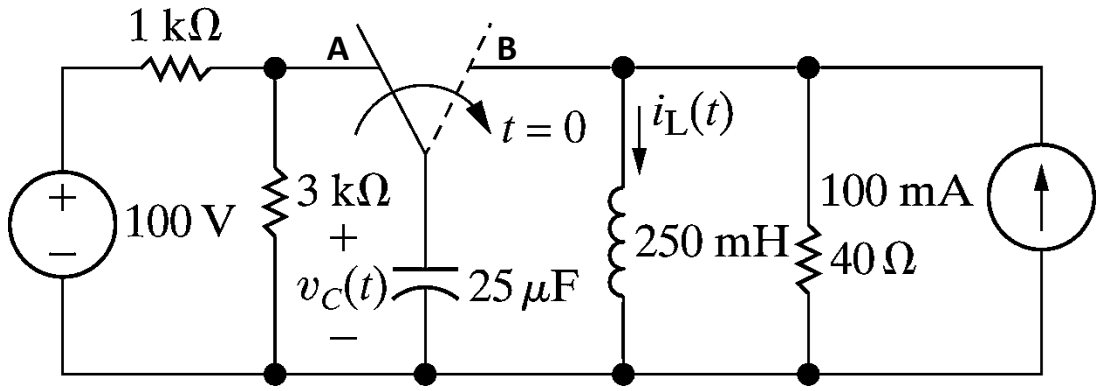
6. For the circuit shown below, the switch has been in position **A** for a long time before switching to position **B** at t=0 (40 points).



a. Draw a sketch of the state of the circuit just before the switch changes to position **B** (e.g. $t=0^-$). Find $i_L(0^-)$ and $v_c(0^-)$.
b. Draw a sketch of the state of the circuit just after the switch changes to position **B** (e.g. $t=0^+$). Find $i_L(0^+)$ and $v_c(0^+)$.
c. Draw a sketch of the state of the circuit after the switch has been in position **B** for a long time ($t\rightarrow\infty$). Find $i_L(\infty)$ and $v_c(\infty)$.
d. Calculate the resonant radian, ω_o, and the neper frequency, α, for the circuit.
e. Determine if the transient response of the circuit is overdamped, critically damped, or underdamped.
f. Write the expression for the inductor current, $i_L(t)$ for $t \geq 0$.

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