ECE 210/211 **Spring 2020**

University of Illinois **Alvarez, Basar, Han, Schuh**

Analog Signal Processing

Thursday, February 20, 8:45-10pm

Exam I

Full Name (First Last): (all capital letters)	

UIN:		**netID:**	

Course: (circle one)		ECE210	ECE211	
Section to return exam: (circle one)	10AM	11AM	1PM	2PM

Clearly PRINT your name in CAPITAL LETTERS.

This is a closed book and closed notes exam.

Calculators are not allowed.

To get full credit, please SHOW all your work and simplify your answers.

Write your final answers in the spaces provided.

All answers should INCLUDE UNITS whenever appropriate.

The exam is printed **double-sided**.

DO NOT write in these spaces.

Problem 1 (25 points):_____

Problem 2 (20 points):_____

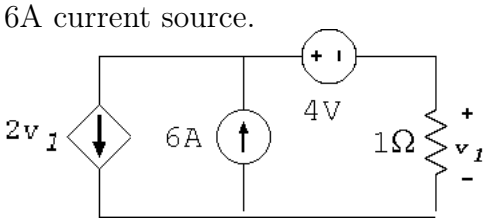
Problem 3 (30 points):_____

Problem 4 (25 points):_____

Total: (100 points):_____

1. (25 pts) The two parts of this problem are unrelated.

(a) [10 pts] For the circuit below, determine v_1 and the power absorbed or delivered by the 6A current source.

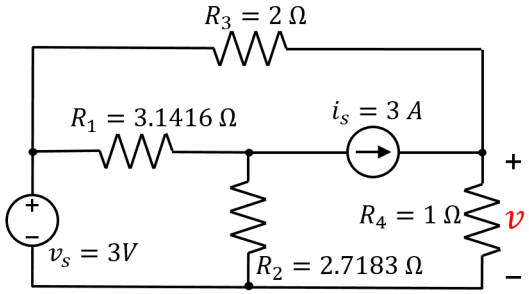


$v_1 =$ _____

$P_{6A} =$ _____

_____ absorbed _____ delivered

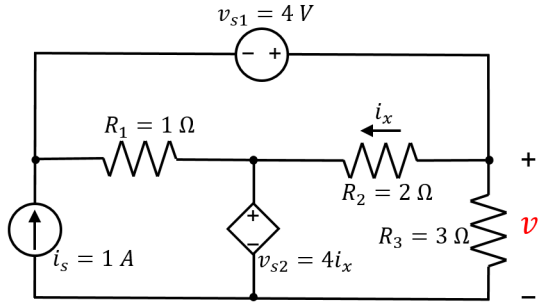
(b) [15 pts] Consider the circuit below. Use the superposition method to determine the constants k_1 and k_2 such that $v = k_1 v_s + k_2 i_s$.



$k_1 =$ _____

$k_2 =$ _____

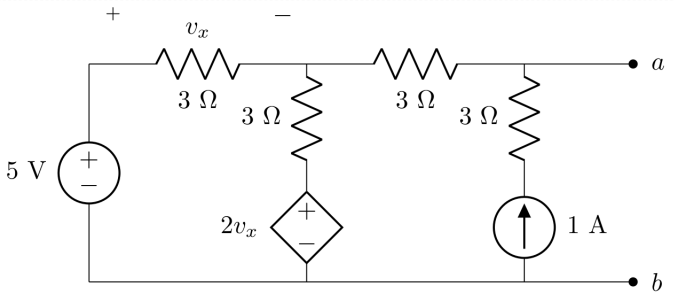
2. (20 pts) Consider the circuit below. Use the node-voltage method to determine v.



$v =$ _____

3. (30 pts) The two parts of this problem are unrelated.

(a) [20] Consider the circuit below.



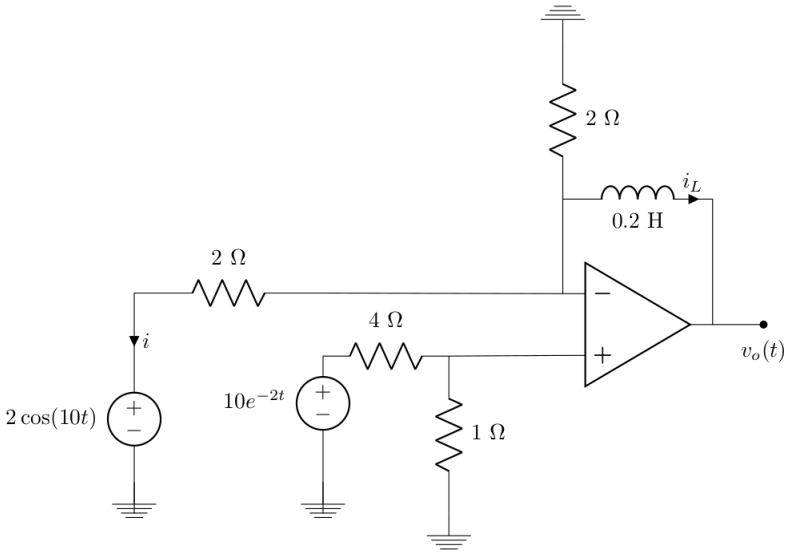
i. [10 pts] Determine the Thevenin equivalent voltage, V_T, between nodes a and b. .

. $V_T =$ _____

ii. [10 pts] Determine the Thevenin equivalent resistance, R_T, between nodes a and b.

$R_T =$ _____

(b) [10 pts] Consider the circuit below.



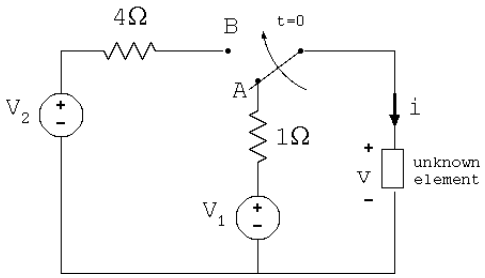
i. [07 pts] Determine the current through the inductor, i_L.

$i_L =$ _____

ii. [03 pts] Determine the output voltage, v_o.

$v_o =$ _____

4. (25 pts) Consider the circuit below. The switch is originally in position A it switches over to position B at time $t = 0$.



(a) [03 pts] If it is known that that $v(0^-) = 5\text{V}$, $i(0^-) = 5\text{A}$, $v(0^+) = 4\text{V}$ and $i(0^+) = 4\text{A}$, is the unknown element a resistor, an inductor or a capacitor? Explain why.

____ resistor ____ inductor ____ capacitor

Explain: _____

(b) [06 pts] If the unknown element is an inductor, and it is known that $v(1) = -20e^{-2}\text{V}$, determine the value of the inductance, L.

$L =$ _____

(c) [16 pts] Assume the unknown element is a 0.01F capacitor and that the switch was in position A for a long time. Determine the constants a, K_1, K_2 and K_3, such that $v(t) = K_1 + K_2e^{-at} + K_3t$, for $t > 0$. You may leave your answers in terms of V_1 and V_2.

$K_1 =$ _____

$K_2 =$ _____

$K_3 =$ _____

$a =$ _____

You may use this sheet for additional calculations but **do not** separate this sheet from the rest of the exam.

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