ECE 210/211 **Fall 2019**

University of Illinois **Alvarez, He, Peng, Shao**

Analog Signal Processing

Thursday, September 26, 8:45-10pm

Exam I

Last Name:	
First Name:	
UIN:	
netID	

Course: (circle one)		ECE210	ECE211	
Section to return exam: (circle one)	11AM	12PM	2PM	3PM

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 (30 points):_____

Problem 2 (25 points):_____

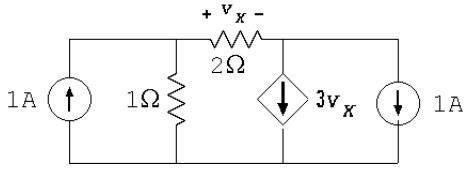
Problem 3 (25 points):_____

Problem 4 (20 points):_____

Total: (100 points):_____

1. (30 pts) The two parts of this problem are unrelated.

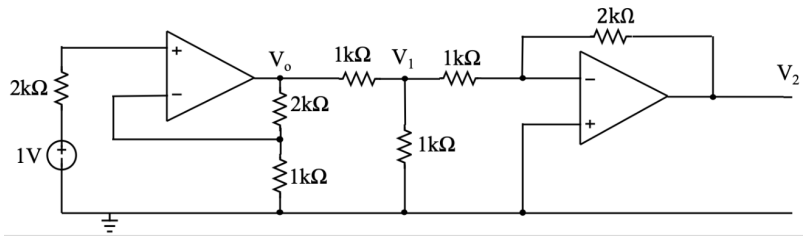
(a) [15 pts] Consider the circuit below. Determine the voltage V_X and the absorbed power at the dependent source, P_{3V_X}.



$V_X =$ _____

$P_{3V_X} =$ _____

(b) [15 pts] Determine the voltages V_0, V_1 and V_2 in the following circuit, assuming linear operation and ideal op-amp conditions.

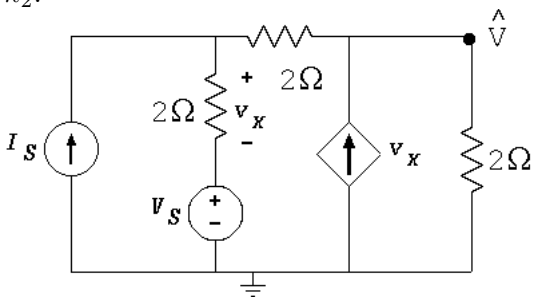


$V_0 =$ _____

$V_1 =$ _____

$V_2 =$ _____

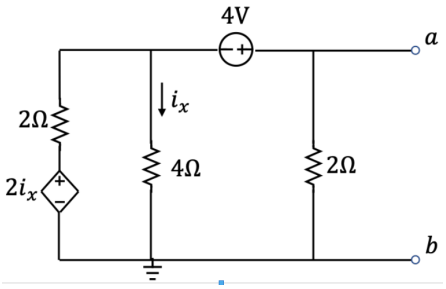
2. (25 pts) Consider the resistive circuit shown in the diagram below. Node voltage $\hat{V}$ can be expressed as $\hat{V} = k_1 V_S + k_2 I_S$. Use superposition to obtain the value of k_1 and the value of k_2.



k_1=_____

k_2=_____

3. (25 pts) Consider the circuit below. Determine Thevenin's voltage, V_T, and Norton's current, I_N, between nodes a and b. Also draw the corresponding Thevenin equivalent circuit and Norton equivalent circuit.



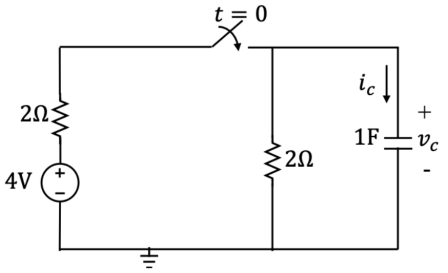
$V_T =$ _____

$I_N =$ _____

Thevenin equivalent circuit

Norton equivalent circuit

4. (20 pts) Consider the circuit below, assuming that $v(0^-) = 1\text{V}$.



(a) [3 pts] Determine $i_C(0^+)$ and $v_C(0^+)$. Explain.

$i_C(0^+) =$ _____

$v_C(0^+) =$ _____

(b) [2 pts] For $t > 0$, determine time constant . Show your work.

$\tau =$ _____

(c) [3 pts] Determine the steady state values of i_C and v_C. Explain.

$i_C(\infty) =$ _____

$v_C(\infty) =$ _____

(d) [8 pts] Express $v_C(t)$ for $t > 0$.

$v_C(t) =$ _____

(e) [4 pts] Sketch $v_C(t)$ for $t > 0$. Label numerical values on the axes.

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

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