Name: _____ (please print)

Signature: _____

ECE 3355 – Quiz #3
October 3, 2019

Keep this quiz closed and face up until you are told to begin.

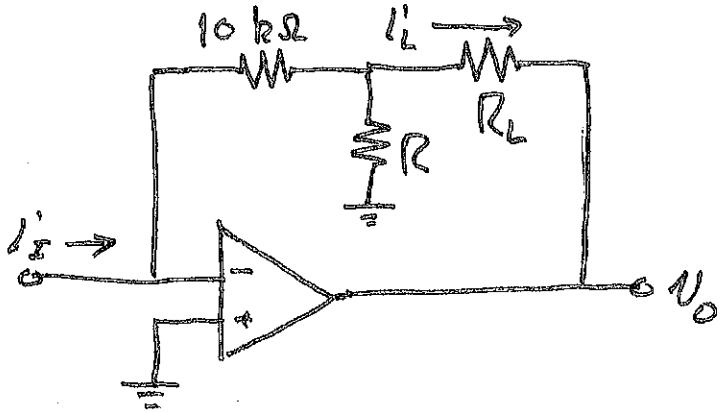
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures.
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

Room for Extra Work

Assume the op amp in the circuit below is ideal. The circuit is intended to be a current amplifier with a gain $i_L/i_I = 20$.

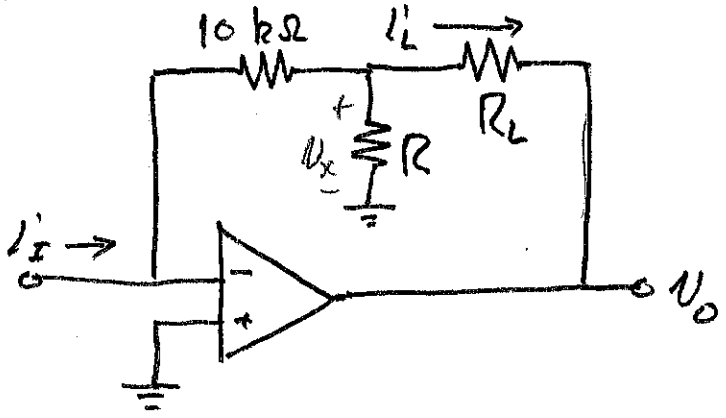
a) Find the value of R necessary to get the specified current gain.
b) Find the input resistance.
c) If the power supplies to the op amp (not shown) are +/- 15 V, what is the largest input current that can be applied?
d) Draw a circuit model for a current amplifier with the characteristics described in this problem. For this part, assume an infinite output resistance.



Room for Extra Work

Assume the op amp in the circuit below is ideal. The circuit is intended to be a current amplifier with a gain $i_L/i_I = 20$.

a) Find the value of R necessary to get the specified current gain.
b) Find the input resistance.
c) If the power supplies to the op amp (not shown) are +/- 15 V, what is the largest input current that can be applied? Use $R_L = 1000\ \Omega$.
d) Draw a circuit model for a current amplifier with the characteristics described in this problem. For this part, assume an infinite output resistance.



a) We have defined v_x: $v_x = -10000\, i_I'$

Then KCL $\quad -i_I' + \frac{v_x}{R} + i_L' = 0$

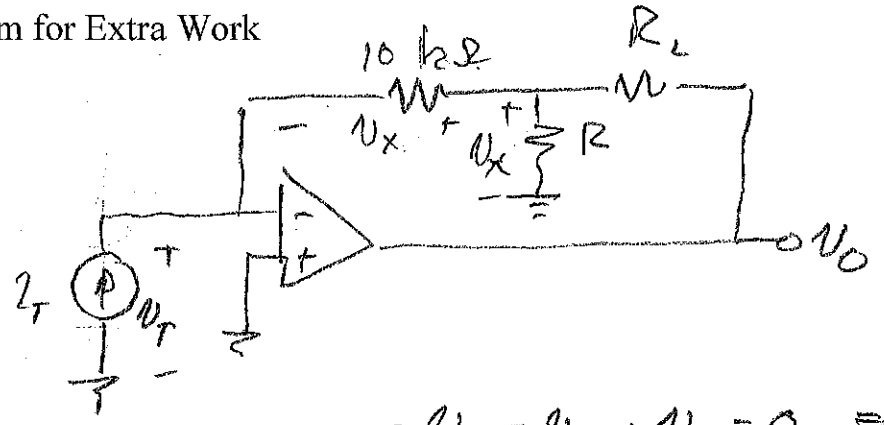
$$\Rightarrow \quad -i_I' - \frac{10000}{R} i_I' + i_L' = 0$$

$$\therefore \quad \frac{i_L'}{i_I'} = 1 + \frac{10000}{R} = 20 \quad \Rightarrow \quad \underline{R = \frac{10000}{19} \approx 526\ \Omega}$$

b) Put a test source at the input:

Note that putting a test voltage source at the input would violate the virtual short ($v_+ = v_-$) so we'll use a current source.

Room for Extra Work



$$-v_T - v_x + v_x = 0 \Rightarrow v_T = 0 !$$

So $\boxed{R_{in} = \frac{v_T}{i_T} = 0.}$

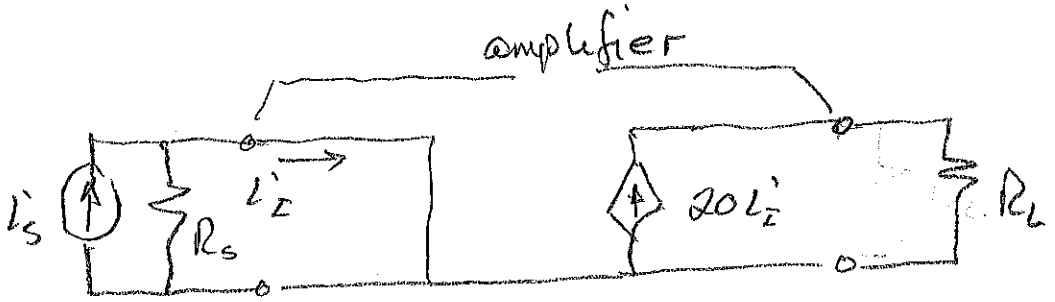
c)

$$v_o + 10000\, i_I' + 20 i_I' \cdot 1000 = 0$$

$$v_o = -30000\, i_I = \pm 15$$

$$\boxed{|i_I'| = \frac{15}{30000} = 0.50\ mA}$$

d) $R_{in} = 0 \quad R_{out} = \infty \quad \frac{i_L'}{i_I'} = 20$



This is an ideal current amplifier !