

EE4086 Quiz 2

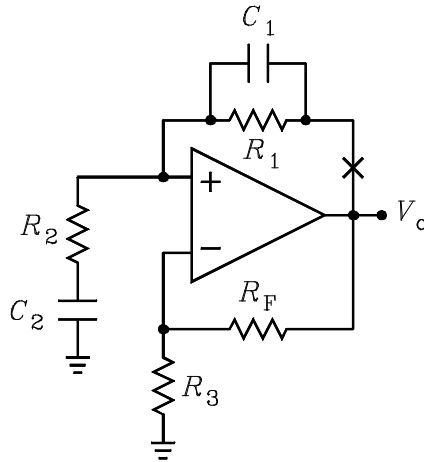
August 19, 1998

Professor Leach

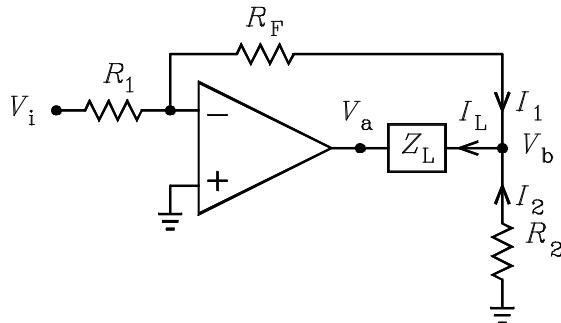
Name _____

Instructions. Print your name in the space above and on all quiz work sheets. Place a box around all answers. Write the word “over” if you continue your work on another page.

- The op amp in the circuit below is ideal.



- Break the loop at the X and solve for the loop-gain transfer function. Express the transfer function as a gain constant multiplied by the ratio of two polynomials in s having no inverse powers of s .
 - For $s = j\omega$, solve for the frequency of oscillation as the frequency where the loop-gain transfer function is a positive real number.
 - What amplifier gain, i.e. the value of $1 + R_F/R_3$, is required for steady-state oscillations?
- For the circuit given below



- Solve for I_L if the op amp is ideal. (Hint, first solve for I_1 and I_2 .) Show that the load Z_L sees a constant current source.

(b) Consider the op amp to have the open-loop transfer function

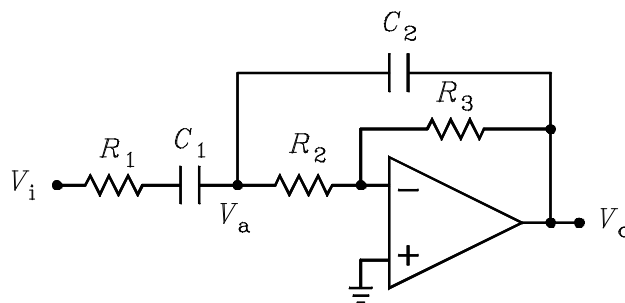
$$V_{\text{out}} = \frac{\omega_x}{s} (V_+ - V_-)$$

Replace Z_L with a test current source of value I_t directed from the V_a node to the V_b node. For $V_i = 0$, solve for V_a and V_b as a function of I_t . Use these to solve for the output impedance transfer function from the equation

$$Z_{\text{out}} = \frac{I_t}{V_b - V_a}$$

(c) Form the equivalent circuit for Z_{out} .

3. The op amp in the circuit below is ideal.



(a) Write a KCL node equation at the V_a node.

(b) Using the above equation and the equation $V_o = (-R_3/R_2) V_a$, eliminate V_a and show that V_o/V_i is a band-pass transfer function of the form

$$\frac{V_o}{V_i} = \frac{-as}{bs^2 + cs + 1}$$

(c) What are the expressions for a , b , and c ?

(d) What are the expressions for the gain constant K , the resonance frequency ω_0 , and the quality factor Q of the circuit?