

EE4435 Quiz 1

July 20, 2000

Professor Leach

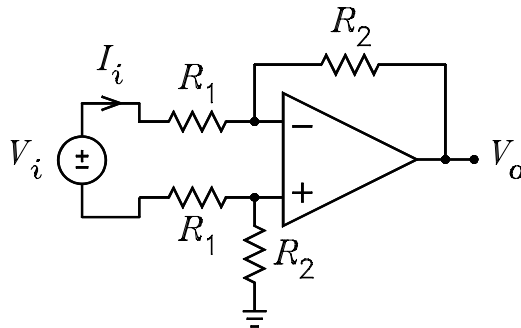
Name _____

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.

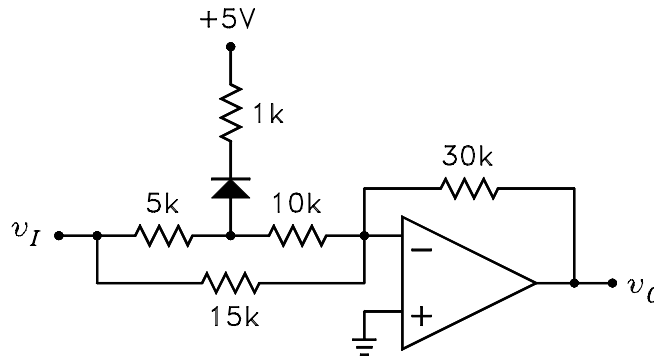
1. A differential amplifier is shown in the figure below. The op amp has the open-loop gain

$$\frac{V_o}{V_{id}} = \frac{\omega_x}{s}$$

where $V_{id} = V_+ - V_-$. Solve for V_o/V_i and $Z_{in} = V_i/I_i$. Put the transfer functions into standard time constant form, i.e. terms of the form $(1 + \tau s)$. Hint, first solve for I_i in terms of V_i and V_o . Then solve for V_{id} in terms of V_i and I_i .



2. The diode in the figure below is ideal. Plot v_o versus v_I for the circuit. Label all slopes and the voltages at the break point.



3. An op amp has the open-loop transfer function

$$\frac{V_o}{V_{id}} = \frac{\omega_x}{s}$$

where $V_{id} = V_+ - V_-$ and $f_x = \omega_x/2\pi = 1$ MHz. The op amp is operated as a non-inverting amplifier with a resistive voltage divider connected between the V_o and V_- terminals so that $V_- = bV_o$.

(a) Show that the closed-loop transfer function is

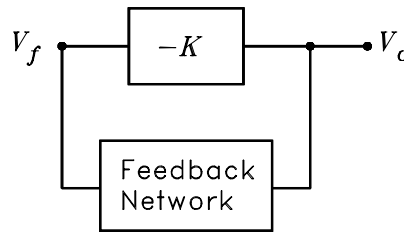
$$\frac{V_o}{V_i} = \frac{1}{b} \frac{1}{1 + bs/\omega_x}$$

where b is the feedback ratio or feedback factor and ω_x is the radian gain-bandwidth product.

(b) The amplifier is operated at a gain of 100. What is the -3 dB bandwidth?

(c) Two such amplifiers are operated in cascade. The gain of each is 10 so that the overall gain is 100. What is the -3 dB bandwidth of the combination?

4. The figure shows an inverting amplifier with a gain $-K$ with a feedback network connected from its output to its input.



The feedback network has the transfer function

$$\frac{V_f}{V_o} = \left[\frac{s/\omega_0}{1 + s/\omega_0} \right]^3$$

(a) What is the condition for oscillations?

(b) Solve for the required value of K and the frequency of oscillations.