Name: ______________________________ (please print)

Signature: ___________________________

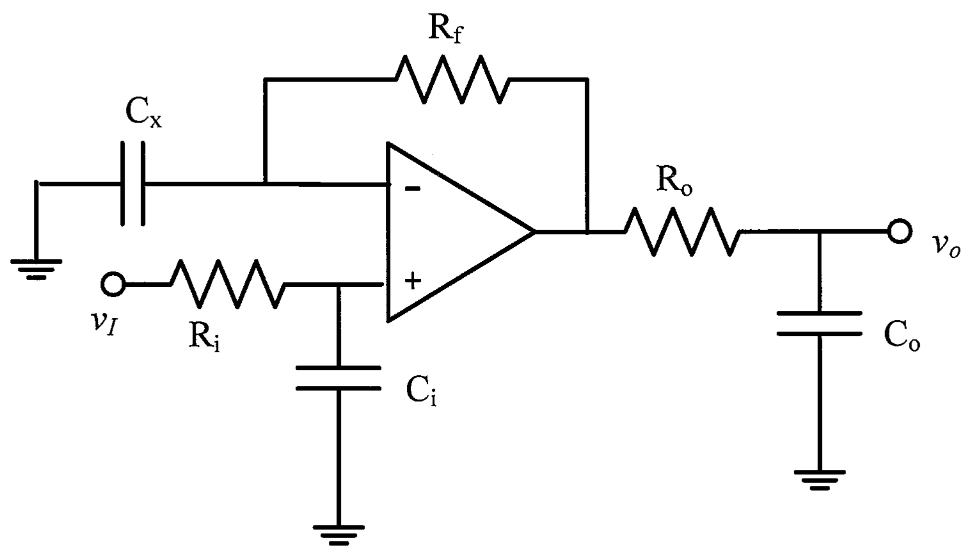
ECE 3355
Quiz #3
June 28, 2017

1. You may have an 8 ½ x 11" crib sheet, but no other materials, and no communication devices of any kind.
2. Show all work necessary to complete the problem on these pages. If you go on to another page, indicate clearly where your work can be found. A solution without the work shown will receive no credit.
3. Show all units in expressions and figures.
4. Do not use red ink.
5. You will have 25 minutes to work on this quiz.

________________/25

The circuit below is intended to act as a band-pass filter.

a) Choose resistor and capacitor values so that the transfer function $T(\omega) = V_o/V_i$ has a 3 dB bandwidth of 100 krad/s.
b) For the parameter values you chose, find the output impedance $Z_o(\omega)$ seen by a load connected to v_o.



Room for extra work

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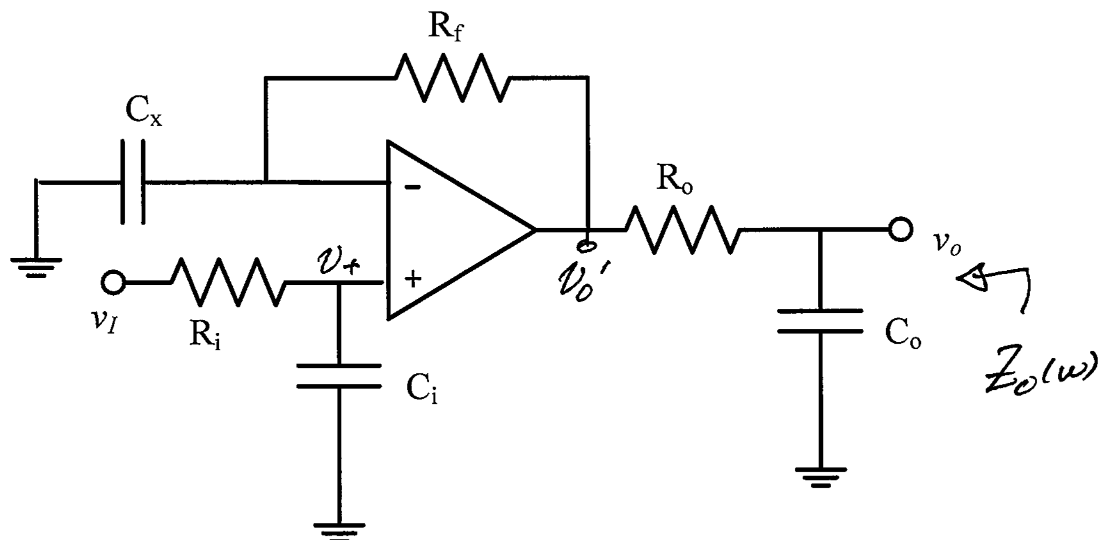


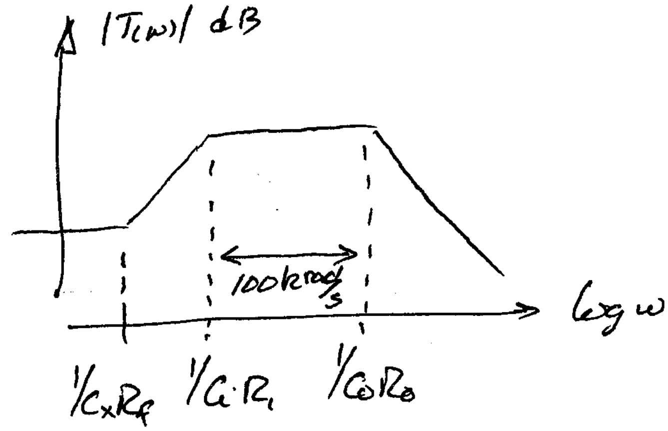
$$V_o' = V_+ (1 + j\omega C_x R_f)$$

$$V_+ = V_i \frac{1}{1 + j\omega C_i R_i} \Rightarrow T(\omega) = \frac{V_o}{V_i} = \frac{(1 + j\omega C_x R_f)}{(1 + j\omega C_o R_o)(1 + j\omega C_i R_i)}$$

$$V_o = V_o' \frac{1}{1 + j\omega C_o R_o}$$

A sketch of the Bode plot, with breakpoints indicated, is on the next page...

Room for extra work



a)

Identifying the first pole with $1/C_iR_i$ was an arbitrary choice - we could have interchanged these poles.

If we choose $1/C_iR_i = 100$ rad/s (also an arbitrary choice),

we need $1/C_oR_o = 100000 + 100 \approx 100\,000$ rad/s

$R_i = 10\ k\Omega$ (another arbitrary choice)

$\Rightarrow C_i = \frac{1}{(10000)(100)} = 1.\ \mu F$

$R_o = 1\ k\Omega \Rightarrow C_o = 0.01\ \mu F$ (you guessed it - another arbitrary choice)

b) $Z_o(\omega) = 1/j\omega C_o \parallel R_o = \frac{R_o}{1 + j\omega C_o R_o}$