ECE 3050 Analog Electronics Quiz 12

April 8, 2009

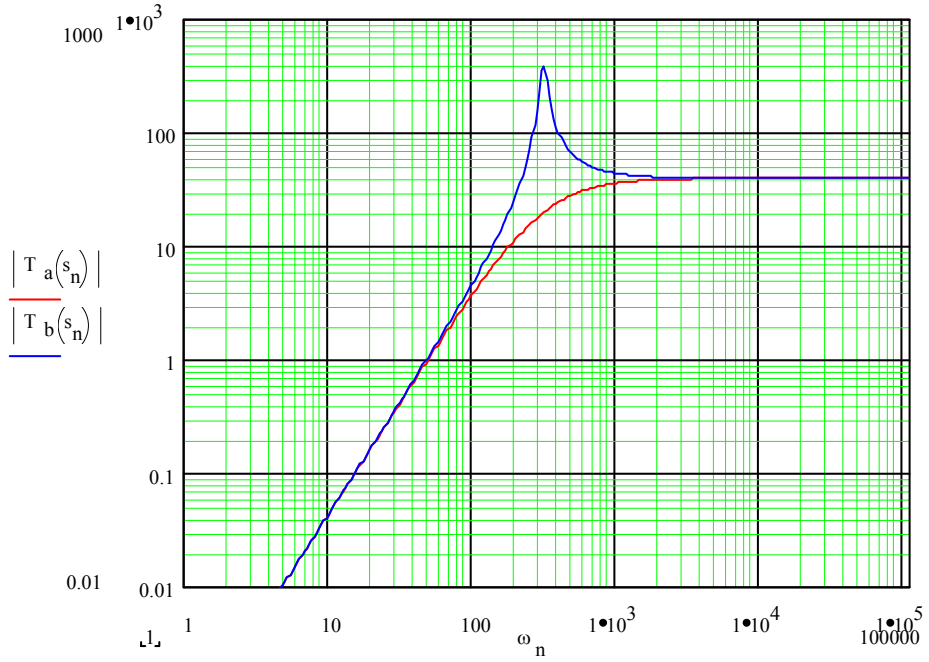
Professor Leach Name_____

Instructions. No calculators are allowed on this quiz. Print your name in the space above. **Honor Code:** *I have neither given nor received help on this quiz.* Initials _____

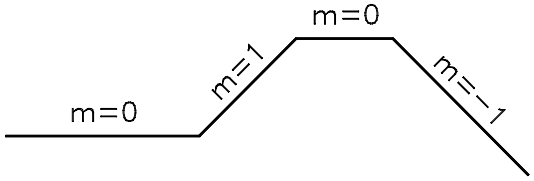
1 of 2. Given the transfer function

$$T(s) = 40\frac{(s/300)^2}{(s/300)^2 + b\,(s/300) + 1}$$

(a) For the case $b = 2$, factor the denominator of the transfer function. Sketch and label the Bode magnitude plot, both the straight-line approximation and the smooth curve, on the log-log scales below.
(b) On the same graph, sketch and label the plot for the case $b = 0.1$. Why is it that you do not factor the denominator for this case?
Answer: Because the roots are complex.

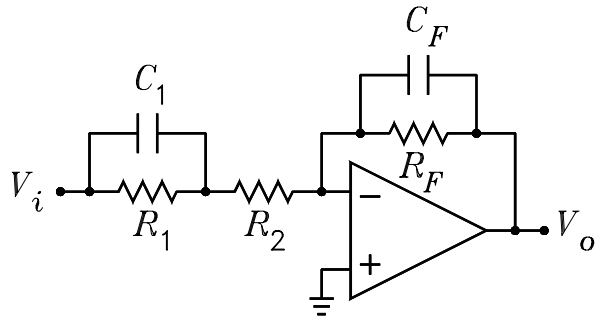


2 of 2. (a) At dc (zero frequency), what is V_o/V_i?
Answer: $-R_F/(R_1 + R_2)$
(b) As ω is increased, it is given that C_1 becomes a short circuit at a frequency well below the frequency at which C_F starts to become a short circuit. What is V_o/V_i in the band between these two frequencies?
Answer: $-R_F/R_2$
(c) For $\omega \to \infty$, what is V_o/V_i?
Answer: 0
(d) Use the information from parts (a) through (c) to sketch the general form of the straight-line approximation to the Bode magnitude plot.



(e) Solve for the transfer function for V_o/V_i and use it to solve for the equations for the break frequencies

in the Bode plot of part (d).



$$\frac{V_o}{V_i} = -\frac{Z_F}{Z_1} = -\frac{\dfrac{R_F}{1+R_F C_F s}}{(R_1+R_2)\,\dfrac{1+R_1 C_1 s}{1+R_1 \| R_2 C_1 s}} = -\frac{R_F}{R_1+R_2}\,\frac{1+R_1 \| R_2 C_1 s}{(1+R_1 C_1 s)\,(1+R_F C_F s)}$$

Zero at $\omega = 1/\left(R_1 \| R_2 C_1\right)$. Poles at $\omega = 1/R_1 C_1$ and $\omega = 1/R_F C_F$