ECEN 3250
Homework 0
(This was the Circuits 1 & 2 Review Exam given in Fall 2003)

These were the exam instructions: This is a 50 minute timed, closed-book, closed-notes test. You may use a handheld calculator. No other materials are permitted. Work in the space provided (or on the back of the page if you need more space). Turn in these sheets. Show all work: partial credit will be given if all steps are shown. This exam contains four problems and seven pages.

Write your name in the spaces provided on the first page and the pages 6 and 7 of the exam.

Page 7 of the exam includes an option to have the class scores reported on the class web site under the codename of your choice.
1. [20 pts] For the circuit shown below,

\[ \begin{align*}
&\text{Figure 1:} \\
&\text{Draw the Thevenin equivalent circuit seen to the left of the terminals A and B, and write expressions for the Thevenin source and resistance.}
\end{align*} \]
2. [15 pts] In the circuit shown in Figure 2(a), an ideal current source $i(t)$ is charging a capacitor $C = 10$ pF. Given $v(0) = 0$, and the current waveshape $i(t)$ shown in Figure 2(b), find and sketch the waveform $v(t)$.

![Figure 2(a)](image1)

![Figure 2(b)](image2)
3. [35 pts] Equivalent circuit diagram of an electronic amplifier is shown below:

Show that the amplifier’s transfer function \( G(s) = \frac{v_{out}(s)}{v_{in}(s)} \) can be written as:

\[
G(s) = G_{\infty} \frac{1}{1 + \frac{s}{\omega_p}},
\]

and find analytical expressions for the high-frequency gain \( G_{\infty} \) and the pole frequency \( \omega_p \) in terms of the circuit parameters \( R_1, R_2, C_1, \) and \( g_m. \) Then sketch and label the magnitude response of the amplifier on the axes below (do just a Bode plot of the magnitude response; the phase response is not required).
4. [30 pts] An amplifier has the transfer function:

\[
G(s) = \frac{V_{\text{out}}(s)}{V_{\text{in}}(s)} = G_o \frac{1}{\left(1 + \frac{s}{\omega_p}\right)^2},
\]

where \(f_p = 1\) MHz and \(G_o = -100\).

On the axes below, construct the magnitude and phase responses (Bode plots) of the transfer function \(G(s)\). Label salient features (break frequencies, slopes, and values of constant asymptotes).
Name: ___________________________________

Student ID: _______________________________

Review Exam Scores:

Problem 1: ___________ out of 20

Problem 2: ___________ out of 15

Problem 3: ___________ out of 35

Problem 4: ___________ out of 30

TOTAL: ___________ out of 100
Name: ___________________________________

Student ID: _______________________________

If you would like to have your scores and the final grade posted on the course web site, choose a codename (8 characters or less) and write it in the space below. If you choose not to fill in the codename, your scores and the final grade will not be posted on the course web site.

Codename: ________________________________