ECE 351 Final Exam
Winter 2013-14

Name____________________

Section 1 or 2

CM____

Scores:
1)  
2)  
3)  
4)  

Total__________

I pledge on my honor that I did not copy any of this exam, and that this work is entirely my own. Furthermore, I did not use PSpice during this exam, except for the lab quiz.

________________________________________
Problem 1 (25 Points):

Find an expression for the gain $\frac{V_o}{V_{in}}$. 

\[ + \quad - \quad U_2 \quad + \quad - \quad \]

\[ R_{10} \quad 10k \quad + \quad R_2 \quad 10k \quad + \quad R_3 \quad 10k \quad + \quad R_4 \quad 10k \quad 0 \]

\[ + \quad - \quad U_4 \quad + \quad R_5 \quad 100k \quad + \quad R_6 \quad 1k \quad 0 \]

\[ + \quad - \quad + \quad R_7 \quad 100k \quad + \quad R_8 \quad 1k \quad 0 \]

Sweep

AC $V_1$

Magnitude = 1

Phase = 0

0

+$ RF \quad 10k$ 

+$ R_1 \quad 1k \quad 0$ 

Vo

Vin

+$ R_{11} \quad 1k$
Problem 2: (25 Points)

Be careful with the feedback of each OP AMP…. Assume that $V_{o1}$ has an initial voltage of 15 V and that the initial voltage on the capacitor is 0 V. Assume that the OP AMPs are idea with a maximum output of +/- 15 V. Both circuits were covered in the notes. Plot $V_{o1}(t)$ and $V_{o2}(t)$ for $t = 0$ to $t = 3.5$ ms.
Problem 3: (23 Points)

a) Determine a numerical value for the current through the capacitor. (9 Points)
b) Plot Vo(t) for t = 0 to t = 5 seconds. Assume that the initial capacitor voltage is 0 V. (9 Points)
c) What is the minimum possible value of Vo if we let the circuit run for a long time. (5 Points)
Problem 4: (27 Points)

A specification for the OPAMPs in the circuit above is:

- $F_T = 3$ MHz (Unity gain bandwidth)
a) Find the upper -3 dB Frequency of each individual OP AMP circuit. To do this, when solving one portion of the circuit with an OP AMP, assume the outputs of the other OP AMPs are ideal voltage sources. (15 Points)
b) Add resistors to the circuit to eliminate the output due to bias currents. The added elements should leave the gain and frequency response of the circuit unchanged. (12 Points)