UNIVERSITY OF CALIFORNIA, BERKELEY
Department of Electrical Engineering and Computer Sciences

EE 100/EE 42                     Summer 2005
Intro. To Electronics Engineering  Bharath “Bart Simpson” Muthuswamy

FINAL
August 12th 2005
Time Allotted: 3 hours

NAME: ___________________________________ , ___________________________
(print)   Last             First

STUDENT ID#:________________

I WILL NOT CHEAT ON THIS EXAM. Signature:_________________________

Note(s):

1. You will receive [3 pts] for filling out the information above.
2. MAKE SURE THE EXAM HAS 10 NUMBERED PAGES.
3. This is a CLOSED BOOK exam. However, you may use THREE 8.5 x 11”
of notes (both sides) and a calculator.
4. SHOW YOUR WORK on this exam. MAKE YOUR METHODS CLEAR
   TO THE GRADER so you can receive partial credit.
5. WRITE ANSWERS CLEARLY IN THE SPACES (lines or boxes)
   PROVIDED.
6. Remember to specify units on answers whenever appropriate.
7. If you are asked to setup equation(s) only, do NOT attempt to solve the
   equation(s).

SCORE:     This page: _______ / 3

1:_______/ 22
2:_______/ 25
3:_______/ 25
4:_______/ 25

TOTAL:_______/ 100
Problem 1 Diodes (22 points)

In the circuit below, assume both diodes are ideal. Find I and V1.

\[ I = \quad \]
\[ V_1 = \quad \]
Problem 1 EXTRA WORKSPACE
Problem 2 NMOS FETs (25 points)

In the circuit below, which elements are absorbing and which elements are releasing power? Specify how much power an element is absorbing or releasing. Use $V_T = 1 \text{ V}$ and $K_P = 50 \text{ uA/V}^2$ for the NMOS.

Power Absorbed or Delivered by Elements

NMOS: ______________________

Current Source: ___________________

Voltage Source: ___________________
Problem 2 EXTRA WORKSPACE
PROBLEM 3 Cascaded Opamps (25 points)

In the circuit below, find \( V_1 \) and \( V_2 \). **DO NOT IGNORE THE EFFECTS OF THE OPAMP RAIL VOLTAGES!**

\[
\begin{align*}
V_1 &= \underline{\phantom{-}\phantom{\pm}\phantom{0}} \\
V_2 &= \underline{\phantom{-}\phantom{\pm}\phantom{0}}
\end{align*}
\]
Problem 3 EXTRA WORKSPACE
PROBLEM 4 Nonlinear Circuit Analysis (25 points)

Suppose you are given the following circuit:

![Circuit Diagram]

The $i$-$v$ relationship of the non-linear circuit is shown below:

![Graph]

(Note: the parabolic portion is not drawn to scale, but the equations are valid.)

a.) Sketch the dynamic route, label all equilibrium points, and describe them as stable or unstable.

b.) Given that $v_c(0) = 4\text{V}$ and $i_c(0) = -4\text{mA}$, how long (in milliseconds) does the current remain constant?
   If the current is never constant, then explain why.

c.) Using the same initial conditions, how long (in milliseconds) does it take for the voltage to reach $0.01\text{V}$?

\[ T_1 \text{ (for constant current)} = \underline{\text{_______}} \]
\[ T_2 \text{ (for voltage to reach 0.01 V)} = \underline{\text{_______}} \]
Problem 4 EXTRA WORKSPACE
EVEN MORE EXTRA WORKSPACE