**Massachusetts Institute of Technology**
**Department of Electrical Engineering and Computer Science**

# 6.002 – Electronic Circuits
# Fall 2003

# Quiz 2

- Please write your name on each page of the exam in the space provided, and circle the name of your recitation instructor and the time of your recitation at the bottom of this page.
- Please verify that there are 16 pages in your exam.
- To the extent possible, do all of your work on the pages contained within this exam. In particular, try to do your work for each question within the boundaries of the question, or on the back side of the page preceding the question. Extra pages are also available at the end of your exam.
- You may use one double-sided page of notes and a calculator while taking this exam.
- Good luck!

| Problem | Points | Score | Grader |
|---|---|---|---|
| 1 | 25 | | |
| 2 | 25 | | |
| 3 | 25 | | |
| 4 | 25 | | |
| Total | 100 | | |

**Name:** _____

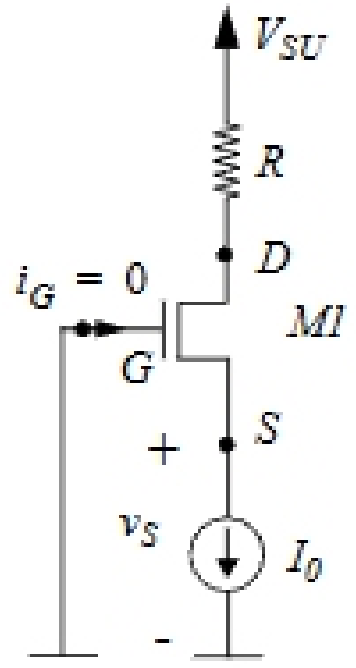
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Instructor:** | Perreault | | Antoniadis | Chaniotakis | | Umans | | Kolodziejski | |
| **Time:** | 10 | 11 | 11 | 11 | 12 | 12 | 1 | 2 | 3 |

**Problem 1 – 25 Points**

Yikes Inc. has manufactured a large batch of identical MOSFETs which unfortunately do not display square-law characteristics. Instead, they are characterized by the following equation when operated in saturation:

$$i_{DS} = K(v_{GS} - V_T)$$

The MOSFETs operate in saturation when $v_{GS} \geq V_T$ and $v_{DS} \geq v_{GS} - V_T$. Yikes begins to experiment with these devices and builds the following circuit containing a single MOSFET $M1$. The supply voltage is $V_{SU}$. Assume for this problem that both $V_{SU}$ and $K$ are greater than 0.




**(A)** Calculate $v_S$, the node voltage at the source, assuming saturation. Note that the gate terminal $G$ of the MOSFET is connected to ground. (8 points)

$v_S =$

**(B)** What is the maximum value of $R$ for which $M1$ satisfies the saturation discipline? (5 points)

Maximum value of $R$ =

**(C)** For a given value of $R$, what are the constraints on $I_0$ for which $M1$ satisfies the saturation discipline? (5 points)

Minimum value of $I_0$ =

Maximum value of $I_0$ =