Field Effect Transistors--Continued

Read all of Chapter 4 in the Textbook

Topics this week: MOSFET Construction, Curves, Operation

The lectures this week will continue with FET circuitry, how construction sets FET device parameters, more detail on how FETs are built, and reasoning behind the constant push for smaller and smaller gates.

Homework, due in class November 10, and review for November 12 Quiz.

1. Examine the curves in this week’s problem repeated below, and describe what changes if we alter mobility, oxide parameters, width and length. Redraw the set of curves and indicate the effect of each of the above changes.

A MOSFET has $V_{tn} = 1.2$ volts and $K_n = 1/1k\text{ohm}$. Plot curves in the Triode region and Pinch-off region on the same plot, for currents from 0 to 10 mA and volts from 0 to 12. Find at least 4 $V_{gs}$ values that result in maximum current of 8 mA and reasonably spaced curves. Connect the two regions by sketching curved lines.

Now plot a load line representing a 9 volt power supply and 1k load resistor. Find the values of $V_{gs}$ that will result in a quiescent current of 2mA, 4A, and 6mA.

2. Sketch a CMOS inverter and describe how it works. Study chapter 4 to figure out how to adjust the threshold voltage so the NMOS device turns on as the PMOS device turns off.

3. Sketch an NMOS small signal amplifier with gate bias circuit, load resistor, and dc blocking capacitors on the input and output. Use $g_m R_L$ to estimate gain.

4. Sketch the cross-section view of an NMOS transistor showing gate, channel, source, drain, oxide, and the wires connecting to gate, source and drain.

Quiz 2:

In Class Thursday November 12. 1 Hour Closed book, no notes, no calculators. Quiz 2 covers Chapter 4 material and laboratory work using diodes circuits.