**ELEC ENG 2EI5**
**Lab 3**

Lab 3 explores the iv-characteristics of MOSFETs.

## Objectives

1. Explore the iv-characteristics of MOSFETs.
2. Extract MOSFET parameters from measurement.

## Safety

- The MOSFETs in your parts kit do not have a high voltage rating. Make sure that you check the maximum ratings for the device on the data sheet and do not exceed them.
- Make sure you understand the bulk connection and connect it to the appropriate voltage, otherwise you will forward bias the pn junctions between the bulk and the source/drain regions and you will destroy the device.
- Simulate before you build!

Be sure to check the ratings of any device before using it. Supplying current or applying voltage in excess of device ratings could destroy the device and/or cause minor burns if you touch a device that is "running hot."

## Lab Requirements

Part 1: Refer to the guided exploration of iv-characteristics in Content Module 1. **Modify** those instructions **or use any alternate experimental setup you identify through your own research** to measure the iv-characteristics of the n-channel MOSFET in your parts kit. You should plot:

a. $i_D$ as a function of $v_{DS}$ for four different values of $v_{GS}$ (including $v_{GS} = 0$);
b. $\sqrt{i_D}$ as a function of $v_{GS}$ for $0 \le v_{GS} \le 4\text{V}$ for $v_{DS} = 4\text{V}$ and $v_{DS} = 5\text{V}$; and
c. $i_D$ as a function of $v_{GS}$ for $0 \le v_{GS} \le 4\text{V}$ for $v_{DS} = 0.25\text{V}$ and $v_{DS} = 0.5\text{V}$.

In each case, discuss what you would expect from theory and how it compares with what you actually measure.

From the different curves that you obtain determine how best to extract values for $K$ and $V_T$. Compare the values you extract with the values given in the data sheets.

Part 2: Repeat Part 1 for the p-channel MOSFET. Remember to switch the polarities of applied voltage and measured current appropriately.

Part 3 (bonus): Figure out how to extract $\lambda$ from your measurements.

## Report Requirements

You are expected to make one submission per report in the Avenue Dropbox for Lab 3. Your submission has to be a single pdf file containing:

1. A photograph of your hardware setup.
2. Your measurement results
    a. This should include explanation of the specific steps you took in your measurements.
    b. This should include screen captures of graphs that were generated by your measurement software or graphs that you generated manually. **Use your judgment: we only need enough graphs to answer the questions you are supposed to investigate**.
3. A brief discussion of any discrepancies between measurement and simulation.
4. A brief discussion of any difficulties encountered in doing the lab and how you did troubleshooting.

I have not specified a particular page limit but you should make your report as brief as you can while meeting the above requirements. Excessive length will be penalized.

## Marking

Your report will be marked on:

1. Experimental work
2. Calculations and discussion
3. Professional presentation and clarity

No simulations are required in this report although you should run simulations before you build your circuit to ensure that you have a working design. A detailed rubric will be posted prior to the deadline for submitting the report.

## Deadline

All deadlines are listed on the course schedule and in the “Labs and Projects” page in the Handbook.