Problems

1) Redraw figure 1.36 with the source and bulk terminals tied together. This is the model that we'll use for the first part of the semester. Did you draw $C_{sb}$? Why?

2) [Discrete vs. Integrated design] Look at figures 3.1 and 3.2.
   a. Redraw them, and circle and label all of the circuit combinations that you can, e.g. common emitter, common source, common collector, differential pair, current mirror, ...
   b. The designs are very different. What quantitative differences are there between the two figures, and what would drive you to one style or the other?

3) [basic amplifiers] Sketch the input/output relationship for an NPN common emitter amplifier with a resistive load. Assume a single-sided 3V supply.
   a. What information would you need to accurately calculate the gain when $V_{out}$ is 2V?
   b. Draw similar sketches for PNP common emitter, NMOS common source, and PMOS common source amplifiers, all with resistive load and single-sided 3V supply.

4) [temperature dependence, datasheets] For a common emitter amplifier made from a Fairchild 2N3904 transistor with a 1kOhm load and a 3V supply, sketch the input/output relationship at -40, 25, and 125C. Try to accurately plot when the output voltage hits 2.9 and 2.0V in each case.

5) [impedance of passives] On a single log/log plot, accurately plot the magnitude of the impedance of the following devices vs. frequency: 1 Ohm, 1k Ohm, and 1M Ohm resistors; 1nF and 1pF capacitors; and 1uH and 1nH inductors. Use a frequency axis from 100 rad/sec to 100G rad/sec.

6) [real world frequencies of interest] Roughly what is the frequency range of human hearing, AM radio, FM radio, Broadcast TV, Bluetooth, 802.11a, b, and g? Label the previous plot with these ranges. Don't forget to convert to rad/sec.