Homework #6 - due Friday, 27 March 2009, 4 pm


2. The donor and acceptor concentrations on the n- and p-sides of a Si abrupt p-n junction are equal to $10^{16}$ cm$^{-3}$. The whole semiconductor is illuminated uniformly such that the hole concentration in the neutral n-region rises to $10^{13}$ cm$^{-3}$. No current is allowed to flow. What will be the reading of a voltmeter whose positive terminal is connected to the p-side at 290 K? (Hint: use law of the junction).

3. A Si abrupt step p-n junction has $N_A = 3 \times 10^{18}$ cm$^{-3}$ on the p-side and an area of $1.6 \times 10^{-3}$ cm$^2$. The junction capacitance is 18 pF at a reverse bias of 3.2 V and 12 pF at 8.2 V. Calculate the built-in voltage and the donor concentration $N_D$ on the n-side.

4. A long-base Si abrupt p-n junction diode with a junction area of $10^{-2}$ cm$^{-2}$ has $N_D = 10^{18}$ cm$^{-3}$, $N_A = 10^{17}$ cm$^{-3}$, $\tau_p = 10^{-8}$ sec, $\tau_n = 10^{-6}$ sec, $D_p = 5.2$ cm$^2$ sec$^{-1}$, and $D_n = 20$ cm$^2$ sec$^{-1}$. Calculate the diode current at a temperature of 300 K under a forward bias of 0.5 V. Include the generation-recombination current and assume a carrier lifetime $\tau_0 = 10^{-7}$ sec within the depletion region.

Homework assignments will appear on the web at:
http://www.ece.udel.edu/~kolodzey/courses/eleg646s09.html

Note: On each homework and report submission, please give your name, the due date, assignment number and the course number.