**ELEG 340: Solid-State Electronics, Fall 2008**

**Homework #7 (rev.) - due Wednesday, 5 November 2008, noon in ECE Dept. Office, 140 Evans**

1. Problem 5.16, p. 244 of Streetman-Banerjee, 6th edition. Hints: using the text's hints about the relative magnitudes of $\varphi_{bi}$ and $V_{rev}$, you can calculate the depletion width with acceptable accuracy (2 significant figures are fine), so you really do not need to know the precise value of $N_D$. The electric field at the junction is just the result of our triangular integration as in class. The field far from the junction in forward bias refers to the so-called neutral region, and is trickier, but sensible. Keep in mind that Ohm's Law will apply here for the *majority* carriers, with no diffusion for them, and use this equation for the total current to get $\mathcal{E}$.

2. Problem 5.19, p. 244 of Streetman-Banerjee, 6th edition.

3. Problem 5.20; calculate depletion capacitance only in reverse bias; p. 244 of Streetman-Banerjee, 6th edition.

4. Problem 5.22, p. 245 of Streetman-Banerjee, 6th edition. Hint: in thermal equilibrium, $E_F$ is constant and $E_i$ is midgap; you may find $(E_i-E_F)$ by assuming that $p = N_A$ far from the junction and by using the standard formula for p versus $n_i$. As the text suggests, you may draw just a smooth curve for $E_C$ and $E_V$ near the junction, because there is no positive "depletion charge" on the more lightly doped p-side of the junction (since there are no $N_D^+$ donors in a p-type sample, what positive charge is there do you suppose?) and the exact details are advanced.

5. Problem 5.24, p. 245 of Streetman-Banerjee, 6th edition. Hints: just use ratios of capacitance, and assume that $\varphi_{bi}$ is negligible compared to $V_{rev}$.

6. Problem 5.40 (a) only; p. 326 of Streetman-Banerjee, 6th edition. Hint: obtain $E_C-E_F$ from the doping, and use the electron affinity to find the work function of silicon with this doping.

7. Problem 8.8; p. 433 of Streetman-Banerjee, 6th edition.

Homework assignments will appear on the web at:
http://www.ece.udel.edu/~kolodzey/courses/eleg340f08.html

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