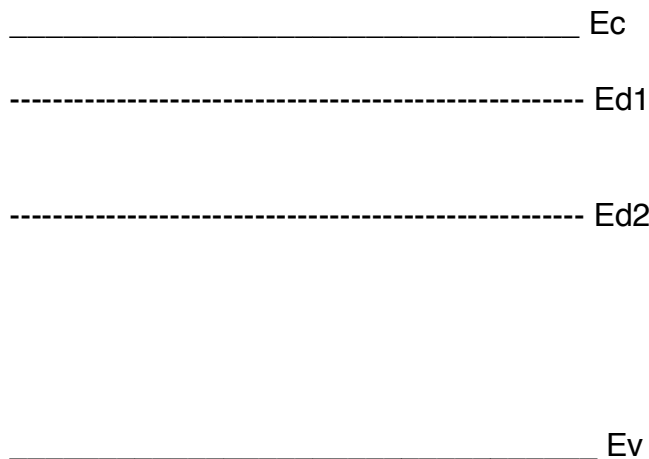


ECE- 132-Homework #3 & 4 counts for two

DUE **Thursday** October 25, 2007 in class

READ CHAPTERS Finish Chap 3 in Streetman, Chap 4, and start Chap 5 to 5.2.3. Solid State Electronic Devices.

- 1) Consider the following case of a semiconductor ($E_g=1.4\text{eV}$) that is doped with two donor levels, E_{d1} and E_{d2} at 20meV and 200meV below the conduction band.
Plot the $\ln(n)$ {the logarithm of the electron concentration} versus inverse temperature ($1/T$). Explain all the important structure in the graph especially the slopes.



2. If an epitaxial layer of GaN has a resistivity of $0.01\ \Omega\text{-cm}$ and a doping density of electrons of $1\text{E}+18\text{cm}^{-3}$, calculate the mobility of the carriers. Now if we made a bar of the GaN that is 1cm long and 0.01cm^2 in cross section calculate the voltage drop across the 1cm bar for 10mA of current.

3. Do Problem 4.7 in Streetman, Solid State Electronic Devices

4. Do Problem 4.8 in Streetman, Solid State Electronic Devices

5. **Excess Carriers**

An n-type Silicon sample with $1 \times 10^{15} \text{ cm}^{-3}$ donors is uniformly optically excited at room temperature such that $1 \times 10^{19} \text{ cm}^{-3}$ Electron-Hole Pairs are generated per second. Sketch the band structure under optical excitation and find the separation of the Quasi-Fermi Levels and calculate the change in conductivity upon shining the light on the sample versus no light. The Electron and Hole lifetimes are both 10 microseconds and $D_p = 12 \text{ cm}^2/\text{sec}$ and $D_n = 33.6 \text{ cm}^2/\text{sec}$.

(Hint: Low level excitation approximation is valid here)