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 (Eg=1.4eV) that is doped with two donor levels, Ed1 and Ed2 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.

_____ Ec

---------- Ed1

---------- Ed2

_____ Ev

2. If an epitaxial layer of GaN has a resistivity of 0.01 Ohm-cm and a doping density of electrons of 1E+18cm-3, calculate the mobility of the carriers. Now if we made a bar of the GaN that is 1cm long and 0.01cm2 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 1E+15cm-3 donors is uniformly optically excited at room temperature such that 1E+19cm-3 Electron-Hole Paris 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 10microseconds and Dp=12cm2/sec and Dn= 33.6cm2/sec.

(Hint: Low level excitation approximation is valid here)