ELEG 646; **ELEG 446 - Nanoelectronic Device Principles**, **Spring 2005**

Homework #3 - due Thursday, 10 March 2005, in class

1.

A 1 cm^3 of a metal has a density of states distribution $N(E)dE = 6.82 \times 10^{21}\sqrt{E}\,dE$, where E is measured from the bottom of the band. The number of electrons in a small energy interval between $E_1 = 4.6$ eV and $E_2 = 4.601$ eV is 2.07×10^{15}. Determine (a) the fraction of the states between E_1 and E_2 occupied by electrons and the position of the Fermi level, and (b) the number of electrons between E_1 and E_2 at 0 °K.

2.

Assuming that the volume of an n-type semiconductor bar with graded doping remains space-charge neutral, determine the impurity distribution $N_d(x)$ and the electric field in the bar. Where are the charges that produce the field located? Assume the problem to be one-dimensional.

3.

In a p-n junction under thermal equilibrium, both the electron and hole currents are zero separately. Prove that this is possible only when

$$\frac{D_p}{\mu_p} = \frac{D_n}{\mu_n} = \frac{kT}{q}$$

4. Muller, Kamins, Chan (3rd ed.): prob 3.6, p. 172.

Homework assignments will appear on the web at:
http://www.ece.udel.edu/~kolodzey/courses/eleg646s05.html

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