**Homework #3 Due Tuesday 10/2/2010 (no extension!)**

**ECEN 5060, Computational Semiconductor Physics**

Consider a bulk (3D) Silicon with parabolic conduction band.

Calculate and plot the electron mobility versus temperature from T=10K to 1300K.

Use the following assumptions:

1. Silicon is doped with Phosphorous with concentration of 1020 cm-3.
2. Dominant scattering mechanisms are due to the ionized impurities and deformation potential of acoustic phonons.
3. Consider only the main conduction band close to the X point and ignore state filling in other bands.
4. Use the matthiessen rule to calculate the total scattering rate:
5. Mobility is calculated from:

where mc is the conductivity effective mass and is the average relaxation time calculated from:

f(E) is the Fermi-Dirac distribution and g(E) is the density of states. The limits of integrals are to be chosen appropriately.

1. ml= 0.98me; mt= 0.19me; εr=11.68; Cl=98x109 N/m2; DA=9 eV