**Homework #5 Due Tuesday 10/26/2010 (no extension!)**

**ECEN 5060, Computational Semiconductor Physics**

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

Calculate and plot the electrical conductivity versus temperature from T=10K to 900K.

Use the following assumptions:

1. N-type GaSb is doped with concentration of 1020 cm-3.
2. Dominant scattering mechanisms are due to the ionized impurities, deformation potential of acoustic phonons, and polar longitudinal optical phonons.
3. Consider two conduction bands at Г and L points and ignore state filling in other bands.
4. Use the matthiessen rule.
5. Calculate the mobility using RTA:

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. Material properties:

Eg =0.813-3.78e-4T2/(T+94) (eV)

Ec(L)-Ec(Г)= 0.089-0.19e-4T2/(94+T) (eV) T in Kelvin

m\*(Г)=0.041me; m\*l(L)= 0.95me; m\*t (L)= 0.11me;

εs=15.7; εinf=15.5;

DA=3 (eV)

ωop=4.5118e+13 (1/sec)

Cl=(10.76-1.26e-3T)\*1010 (N/m2)

ρ=5.61 (g/cm3)

vs=(C1/ ρ)1/2 sound velocity