ECE 656: Fall 2011
Lecture 2 Homework
Due Wednesday, August 31, 2011

1) Assume T = 0K and work out the electron density per unit area for two cases:
   i) a 2D semiconductor with parabolic energy bands and an effective mass of m^*
   ii) graphene, where we consider $E > 0$ to be the conduction band. ($E = 0$ is where the bands cross, the so-called Dirac point.)

   1a) Express your two answers in terms of the Fermi energy, and show that they are different.

   1b) Express your two answers in terms of the Fermi wavevector and show that they are the same.

2) Assume a finite temperature and work out the sheet carrier densities, n_S, for a 2D parabolic band semiconductor and for electrons in the conduction band ($E > 0$) of graphene.

3) Assume T = 0K and work out the average +x-directed velocity for electrons in:
   i) A 2D semiconductor with parabolic energy bands and
   ii) In the conduction ($E > 0$) of graphene.

   Your answer should be in terms of the Fermi energy, E_F.