ECSE-2210 Microelectronics Technology
Homework 2

Reading Assignment: Pages 40-74. Late submissions will be penalized. Hand in your solutions during the class.

1. A Si sample is doped such that it has 10^{17} cm^{-3} electrons in its conduction band (i.e. $n = 10^{17}$ cm^{-3}) at both 300 K and 200 K. Calculate the hole concentrations at 300 K and 200 K. Figure 2.20 has the n_i values for various temperatures.

2. (Problem 2.17 in text) Determine the equilibrium electron and hole concentrations inside a uniformly doped sample of Si under the following conditions:

   (a) $T = 300$ K, $N_A << N_D$, $N_D = 10^{15}$ cm^{-3}.

   (b) $T = 300$ K, $N_D << N_A$, $N_A = 10^{16}$ cm^{-3}.

   (c) $N_A = 9 \times 10^{15}$ cm^{-3}, $N_D = 10^{16}$ cm^{-3}, $T = 300$ K.

   (d) $N_D = 10^{14}$ cm^{-3}, $T = 450$ K.

   (e) $N_D = 10^{14}$ cm^{-3}, $T = 650$ K.

3. (Problem 2.18 in text) For each of the conditions specified in Problem 2, determine the position of E_i , Compute E_F - E_i , and draw a carefully dimensioned energy band diagram for the Si sample. Note: E_G (Si) = 1.08 eV at 450 K and 1.015 eV at 650 K. Also, read exercise 2.4 in text (page 55).