

ECEn 450, Winter 2010
Homework #5
Due February 9, 5:00 pm

From the text Semiconductor Devices, Physics and Technology, do the following problems:

Chapter 3, problems 2, 5, 11

Chapter 11, problems 1, 2

Also complete the following problems:

5.1 (a) In a p-type gallium arsenide semiconductor, the conductivity is $\sigma = 5 (\Omega\text{-cm})^{-1}$ at $T = 300\text{K}$. Calculate the thermal-equilibrium values of the electron and hole concentrations. (b) Repeat part (a) for n-type silicon if the resistivity is $\rho = 8 \Omega\text{-cm}$.

5.2 The hole concentration in germanium at $T = 300\text{K}$ varies as

$$p(x) = 10^{15} \exp(-x/22.5) \text{ cm}^{-3}$$

where x is measured in μm . If the hole diffusion coefficient is $D_p = 48 \text{ cm}^2/\text{s}$, determine the hole diffusion current density as a function of x .