ECE 447/547 (Semiconductor Devices)
Southern Illinois University Carbondale

Homework 06

Q1. An *n*-type silicon semiconductor resistor is to be designed so that it carries a current of 5 mA with an applied voltage of 5 V. If $N_d = 3 \times 10^{14}$ cm^{-3} and $N_a = 0$, design a resistor to meet the required specifications.

Q2. Textbook problem 5.35

Q3. A sample of semiconductor has a cross-sectional area of 1 cm^2 and a thickness of 0.1 cm. Determine the number of electron–hole pairs that are generated per unit volume per unit time by the uniform absorption of 1 watt of light at a wavelength of 6300 Å. Assume each photon creates one electron–hole pair. (b) If the excess minority carrier lifetime is 10 μs, what is the steady-state excess carrier concentration?

Q4. Textbook Exercise 6.3 (page #208)

Q5. **For ECE 547 Students:**
Design (that is, find the cross-sectional area of) a GaAs photoconductor that is 2 μm thick. Assume that the material is doped at $N_d = 10^{16}$ cm^{-3} and has lifetime values of $\tau_{n0} = 10^{-7}$ s and $\tau_{p0} = 5 \times 10^{-8}$ s. With an excitation of $g = 10^{21}$ cm^{-3} s^{-1}, a photocurrent of at least 1 μA is required with an applied voltage of 2 V.