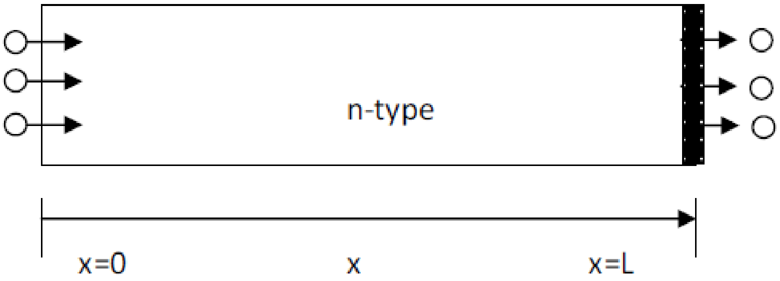
ECE-606 Homework No. 5 Assigned: Sept. 18 Due: Sept. 25

1) Holes are injected and extracted in to an n-doped semiconductor at x = 0 as shown in the figure below. However, the doping is not perfectly uniform such that there is a small internal electric field E. Assume that the semiconductor is maintained in the dark and with low level recombination and the right end is contacted with a metal.

   a. Obtain an expression for the excess hole density in terms of $\Delta p(x=0)$ and at steady state condition

   b. Assuming that the minority carrier lifetime is 100ns and the hole mobility is 400 cm^2/Vs, compute the drift and diffusion current. You can assume that L=10mm, $\Delta p(x=0) = 1\times10^{15}/cm^3$ and E=10V/cm at x=0.



2) Solve ASF 5.10

3) Calculate the resistivity of intrinsic silicon at room temperature. Further, assume that this piece of intrinsic silicon is now n-doped with a concentration equal to $10^{16}/cm^3$. Compute the resistivity for the n-type silicon

4) A semi-infinite n-type semiconductor bar is subject to uniform penetrating illumination resulting in a generation rate of G electron-hole pairs per second per cm^2 throughout the bar. G is such that sample remains in low-level injection. Minority carriers are extracted at the surface at $x = 0$. Obtain an expression for the maximum hole current that can be drawn from the bar in steady-state.

5) Consider a region in a semiconductor that is totally depleted of carriers ($n = p = 0$). Obtain an expression for the energy level of the RG centers relative to mid-gap $\Delta E = (E_T - E_i)$ that results in the highest possible generation rate. Your answer should include the minority carrier lifetimes.

6) Define the following **1**. IMREF **2**. Matthiesen Rule **3**. Auger recombination (draw a sketch too). **4**. Hall coefficient