EE331 Devices and Circuits 1
Spring 2014

Homework 4
Due in class on Friday, May 2 2014.

1. Consider a silicon pn junction diode with area A $= 20$ μm^2, $N_A = 2 \times 10^{18}$ cm^{-3} on the p-type side and $N_D = 5 \times 10^{16}$ cm^{-3} on the n-type side. Use $n_i = 1.0 \times 10^{10}$ cm^{-3}. Assume that the p-type region is much smaller than the diffusion length with $W_p' = 500$ nm but n-type region is long with hole diffusion length $L_p = 50$ μm. Assume that generation/recombination in the depletion region can be neglected and that the minority carrier injection levels are substantially lower than the majority concentration levels (low-injection condition).

   a) Calculate the charge storage in the depletion region for applied voltages of -1 V, 0.6 V and 0.8 V.
   b) Calculate stored forward injection charge (diffusion charge) for applied voltages of -1 V, 0.6 V and 0.8 V.
   c) Determine the average depletion and diffusion capacitance over diode voltages of -1 to 0.6 V and 0.6 to 0.8 V. Comment on your results.

2. Jaeger & Blalock Problem 4.1.

3. Jaeger & Blalock Problem 4.4 (b) and (d).

4. Jaeger & Blalock Problem 4.7.

5. Jaeger & Blalock Problem 4.10.

6. Jaeger & Blalock Problem 4.20.

7. Describe the properties that you would look for in a semiconductor to be used for an LED that emits blue light?