

# Device Simulation Lab

## EE534P

### Problem sheet 9

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**(The lab is about simulating pn junctions in equilibrium)**

1) Consider a step pn junction of Si with uniform doping of  $N_D$  &  $N_A$  on the n and p sides of the junction. Solve for the electrostatics under equilibrium conditions using Newton-Raphson method. Plot the charge density, electric field & potential distribution inside the device. Also plot the energy band diagram. Compare your numerical results with the analytical solutions as discussed in the class. Do it for 3 cases mentioned below:

a)  $N_A = N_D = 10^{16} \text{ cm}^{-3}$

b)  $N_A = 10^{15} \text{ cm}^{-3}$  &  $N_D = 10^{16} \text{ cm}^{-3}$

c)  $N_A = 10^{16} \text{ cm}^{-3}$  &  $N_D = 10^{15} \text{ cm}^{-3}$

You can take the length of the device around  $4 \mu\text{m}$ , take one half of the region as n type and another half of the region as p type.

2) Simulate the above structure in sentaurus. You may take the width of the device to be  $2 \mu\text{m}$ . Plot the charge density, electric field, potential distribution and the energy band diagrams.