LAB 5
Reverse Biased PN Junction and Capacitance

OBJECTIVE: to learn the concepts of built-in voltage, depletion width, and the space-charge of the depletion region. Students should be able to calculate the built-in voltage and capacitance of the reverse-biased pn-junction. The corresponding parameters and concepts are to be visually understood from the applet.

PROCEDURE

1. Run the "Mathlab Animations" on your PC.
2. Run "Section 2.2: P N Junction Energy Bands and Capacitance". Change the doping concentrations and applied bias to see the influence on the depletion region width and capacitance. Comment on the changes with:
    a. Donor and acceptor concentrations change;
    b. Applied voltage;
3. Illustrate your answers with appropriate screenshots.
4. Calculate the PN Junction parameters: For a Si PN junction diode with $N_a=3*10^{18}/cm^3$, $N_d=7*10^{15}/cm^3$ and T=300 K, Assume $n_i=1.5x10^{10}/cm^3$ with no external voltage applied.
    a. Find the value of built-in potential V_{bi}.
    b. What is the width of the depletion region, and how far does it extend into the p and n regions?
    c. If the cross sectional area of the junction is 2500 mm^2, find the magnitude of charge stored in either side of the junction and calculate the junction capacitance C. Compare your result with that in the simulation applet.