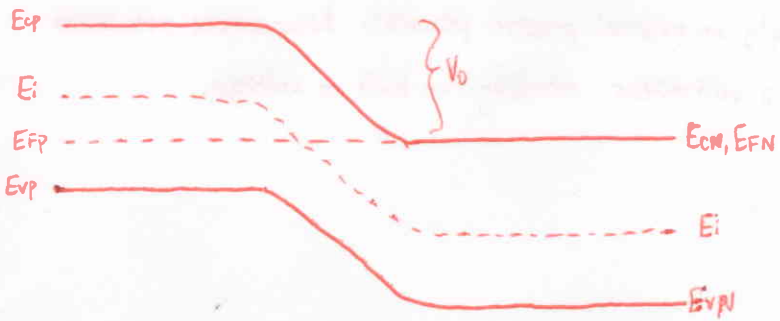
ECE 340: Quiz #2, V3

Name: Solutions

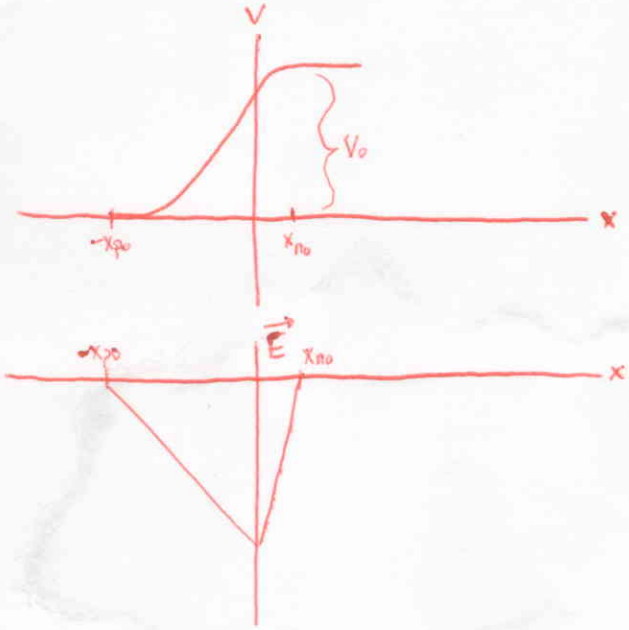
1) Consider a P-N^+ junction shown below

P	N^+

a) Draw the energy band diagram at equilibrium, and indicate schematically the position of E_i, E_F, E_c and E_v. (4 points)



b) Sketch the junction potential and electric field. Pay attention to the relative distance scale on each side of the junction. (2 points)



since $N_D >> N_A \longrightarrow x_{po} >> x_{no}$

c) On which side of the junction is the space charge region the most extended? Why? (2 points)

The p-side of the junction is the more extended side. Since the p-n+ junction is in equilibrium, there must be an electronic space charge balance between both sides. Because the n-side is more heavily-doped, its carrier concentration is larger and requires the space charge region to be smaller. Therefore, the small p-side concentration has a larger space region to match up.

d) If you place a voltmeter across this diode, do you expect to measure V_0? (2 points)

No. The built-in potential, V_0, is an intrinsic value of the junction required to maintain equilibrium and does not imply an external junction potential. New contact potentials will arise upon connecting a voltmeter, cancelling the built-in voltage.