EE 735: ASSIGNMENT 2 REPORT

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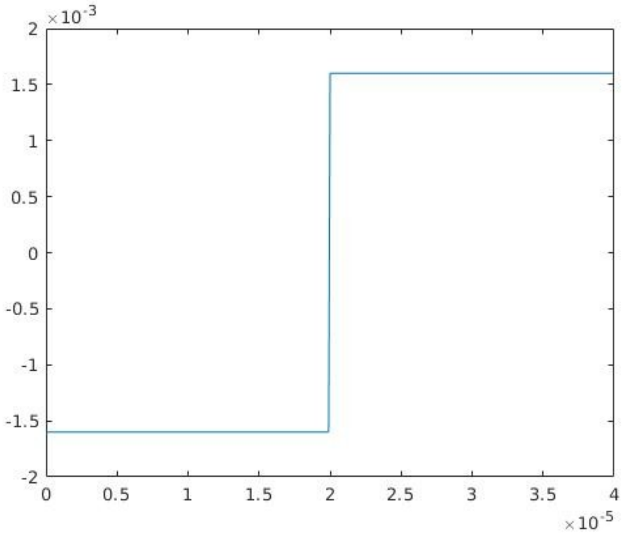
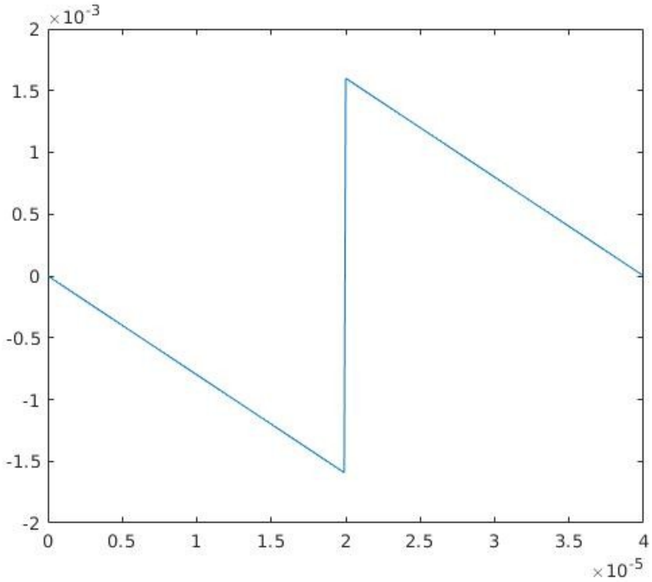
Q1. I keep length of ntype = length of ptype = 200nm
p-type is from 0-200 nm and 200-400 nm is ntype in the xgrid.
$N_D = 10^{16}$ cm $^{-3}$, $N_A = 10^{16}$ cm $^{-3}$
For the abrupt junction,
in 0-200(x_P) nm, we say that roh = -q*N_A and 200-400($x_P + x_N$)nm, we say that roh = q*N_D

For the abrupt graded junction, roh is as follows:



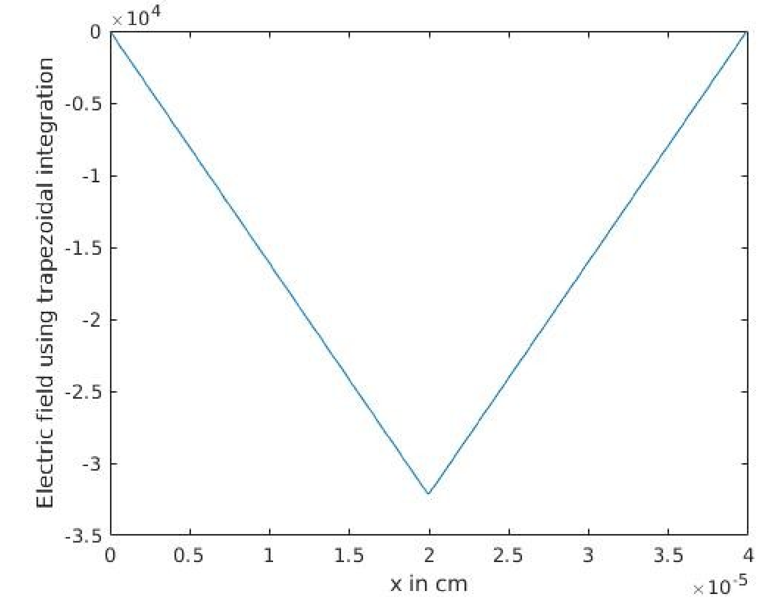
For the linearly junction,
in 0-200(x_P) nm, we say that roh = -(q*N_A/x_P)*x; and 200-400($x_P + x_N$)nm, we say that roh = -(q*N_D/x_N)*($x_N + x_p$ - x);

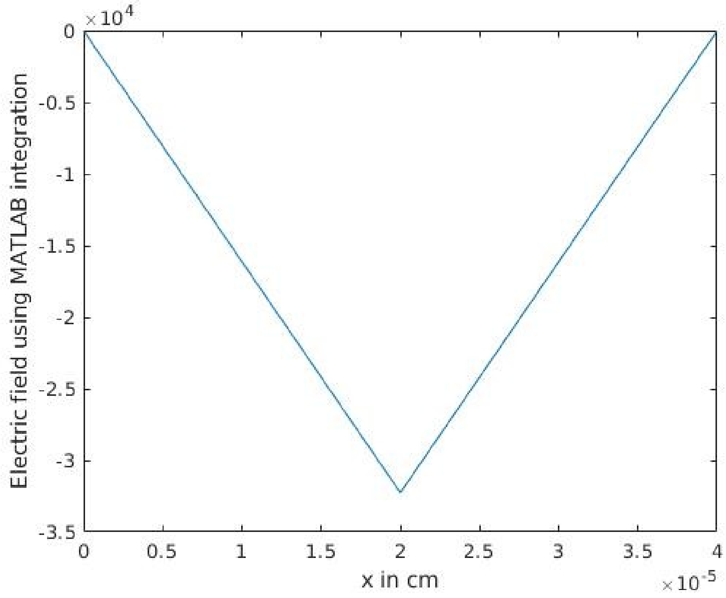
For the linearly graded junction, roh is as follows:



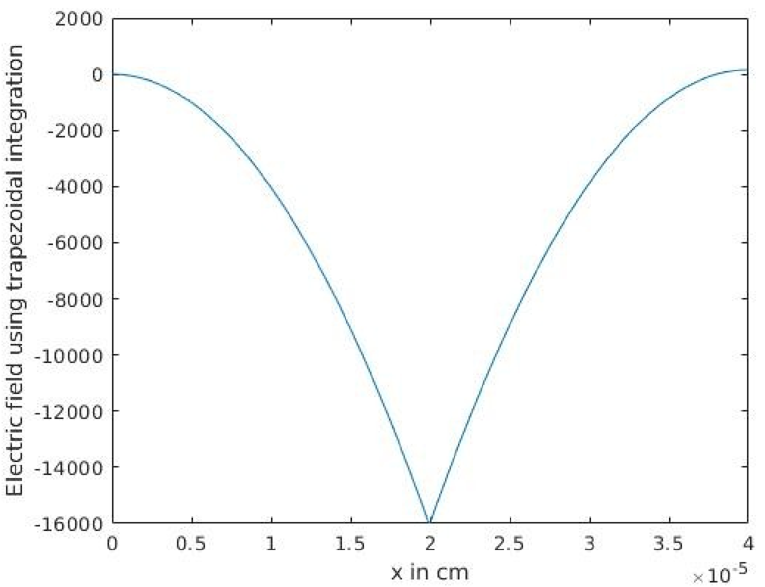
Q1 a) Electric field profile by solving the Gauss Law using numerical integration techniques such as Trapezoidal method

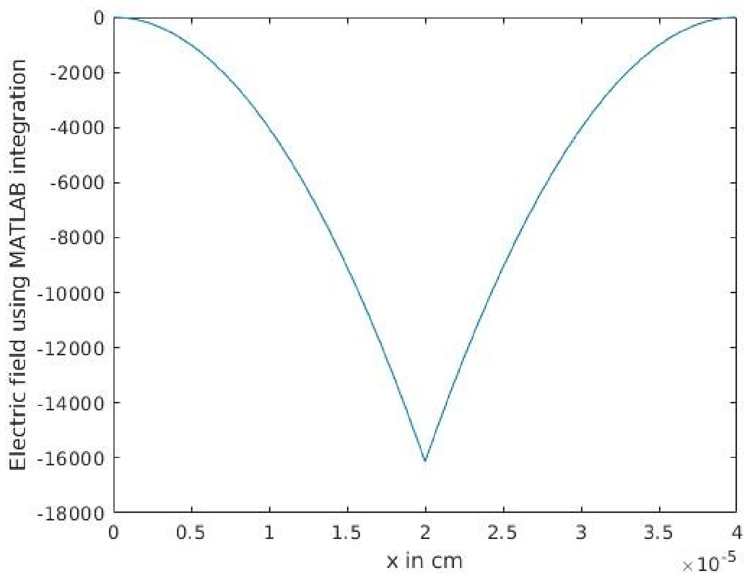
i) Abrupt junction





ii) Linearly graded junction

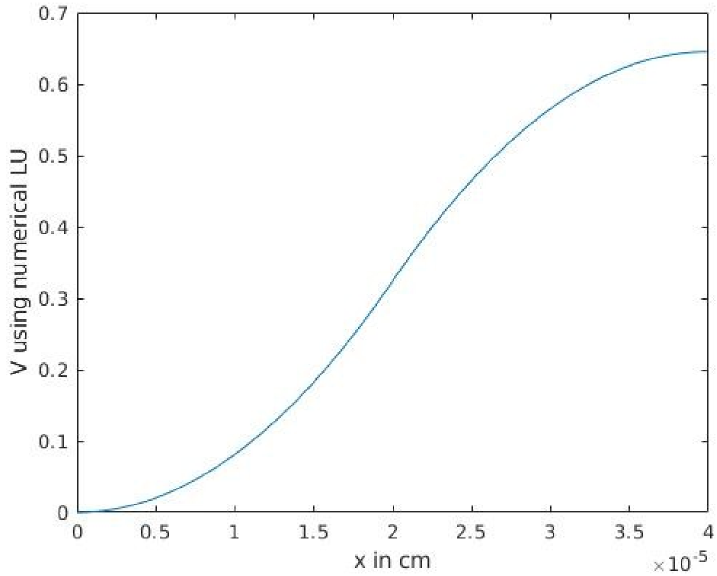


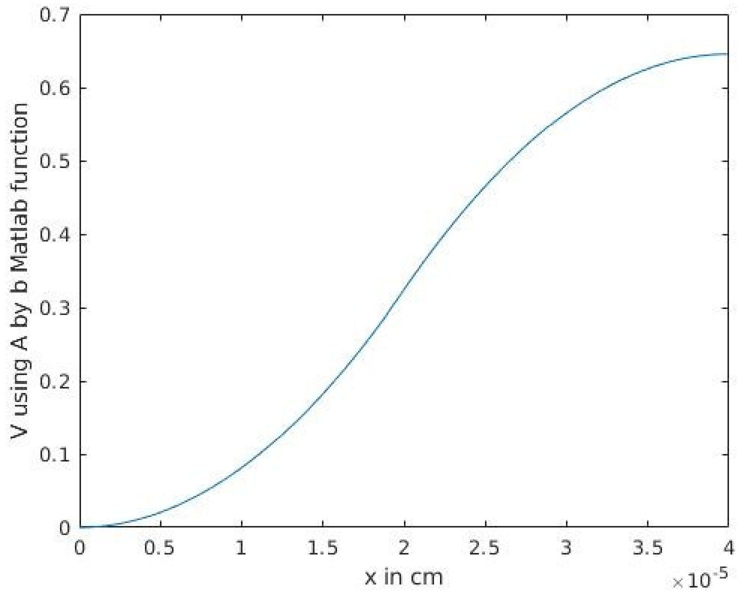


In case (i), numerical and MATLAB integration work similarly.
A slight difference can be seen in case (ii) where electric field doesn't come out to be exactly zero at x=400nm boundary using the numerical integration technique.

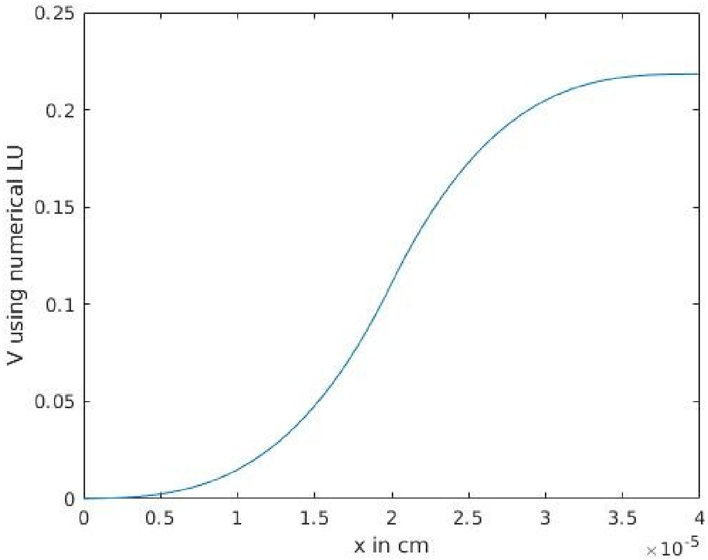
Q1 b) Using central difference discretization scheme, solved the Poisson equation with depletion approximation.

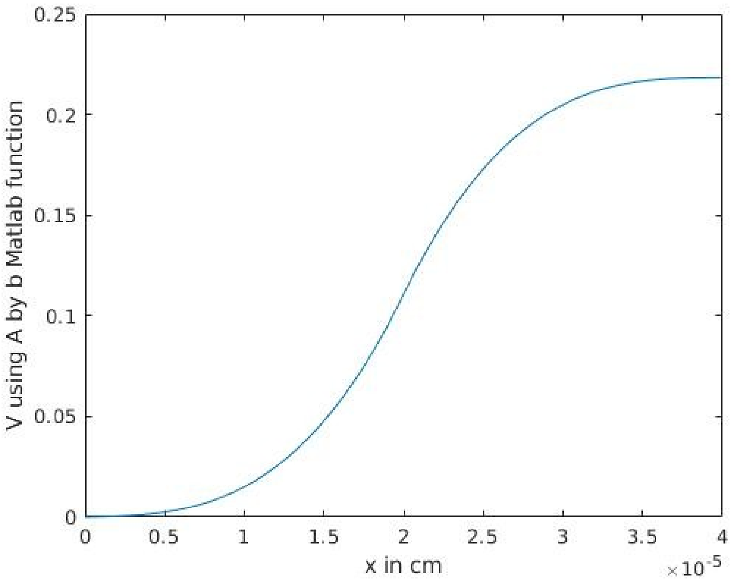
i) Abrupt junction





ii) Linearly graded junction





LU decomposition matrices obtained were nearly equal from numerical and MATLAB methods

Q2. Doping concentrations $N_D = 10^{16}$ cm $^{-3}$, $N_A = 2*10^{15}$ cm $^{-3}$. Used Newton Raphson method to solve the charge neutrality equation for finding the fermi energy E_F.

Taking $E_V = 0$; $E_D = E_C - 0.045$ eV; $E_A = E_V + 0.045$eV at 300K
and solving the equation, we obtain $E_F = 0.8895$ eV