Rensselaer EE EPE CSE
Department of Electrical, Computer, & Systems Engineering

Homework 4
Part One
Due 14 October at 6:00 pm

1. Coaxial Cable Electric Field

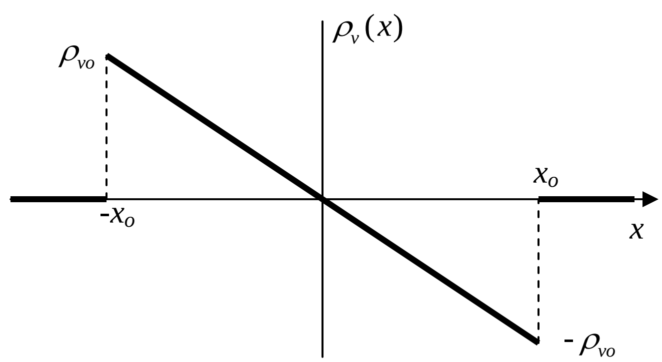
a. Using the solution to problem 2 of HW3, write the electric field $\vec{E}(r)$ of the CATV coaxial cable in full vector form (with unit vector) making sure you have provided an expression for all values of r. Also, write down the values of the inner and outer radii of the cable and its dielectric constant ε.
b. Assuming that outer conductor is grounded, determine the voltage (electric potential) $V(r)$ for all values of r. Plot your solution as a function of radius.
c. Show that your solution satisfies Laplace's Equation.

2. The Earth-Ionosphere Capacitor

a. From the solution to problem 3 of HW2, write down the expression for the electric field vector $\vec{E}(r)$ as a function of radius in the region between the surface of the earth and the ionosphere. Be sure it is in full vector form.
b. Assuming the surface of the earth is grounded, determine the voltage (electric potential) $V(r)$ for all values of r. Plot your solution as a function of radius.
c. Show that your solution satisfies Laplace's Equation.

3. The Electric Field and Potential of a Charge Distribution

a. The volume charge distribution in the planar structure of problem 4, HW3 is reproduced below. From the solution to this problem, write down the electric field as a function of x $\vec{E}(x)$ in full vector form.



b. Assuming that the voltage is equal to zero at $x=0$, determine the voltage as a function of x $V(x)$ for all values of x. Plot your solution. *Hint: to use Matlab for the plot, you will have to pick numerical values for the unspecified constants.*
c. Show that your solution for $V(x)$ satisfies Poisson's Equation.