Physics 370 **Homework 4** **Due Monday February 19, 2018**

Reading: Griffiths pages 77-93.

<u>Problem 1</u> A long coaxial cable (see Fig. 2.26 in Griffiths) carries a uniform *volume* charge density ρ within the solid inner cylinder of radius a. It also has a uniform *surface* charge density on the outer cylindrical thin shell of radius b. This surface charge density is negative and of just the right magnitude so that the cable as a whole is electrically neutral. Find the electric field in each of the three regions:
(i) inside the inner cylinder ($r < a$),
(ii) between the cylinders ($a < r < b$), and
(iii) outside the cable ($r > b$).

<u>Problem 2</u> Find the potential $V(r)$ for Problem 1, for all r. You may choose any (fixed) convenient reference point for your potential.

<u>Problem 3</u> An infinite plane slab has thickness $2d$ and carries a uniform volume charge density ρ. Its surfaces are planes of constant y, namely $y = d$ and $y = -d$. Find the electric field as a function of y, both inside and outside of the slab. (Note that $y = 0$ is the center of the slab.) Make a graph of E_y as a function of y.

<u>Problem 4</u> Find the potential $V(\vec{\mathbf{r}})$ for Problem 3, for all $\vec{\mathbf{r}}$. You may choose any convenient reference point for your potential.

<u>Problem 5</u> In some region of space, the electric potential is given in rectangular coordinates by $V = k_1x^2 + k_2y^2 + k_3z^2$, where k_1, k_2 and k_3 are positive constants. What are the electric field and the volume charge density in that region? Where could the reference point for this potential be?