Physics 8100 - Electromagnetic Theory I

Fall 2017 **N. Dietz**

Assignment # 3 (due to Monday, October 02, 2017)

1) **Problem 1.4**, Jackson textbook (page 51): Each of three charged spheres of radius a, one conducting, one having an uniform charge density within its volume, and one having a spherically symmetric charge density that varies radially as r^n ($n > -3$), has the total charge Q. Use the Gauss's theorem to obtain the electric fields both inside and outside each sphere. Sketch the behavior of the fields as a function of radius for the first two spheres, and for the third with n=-2, +2.

2) Find the potential and the electric field strength along the axis of a thin uniformly charged circular disc of radius *R* and total charge *q*. Show that the normal component of the field changes by σ/ε_0 on passing through the surface of the disc. Consider the field at large distances from the disc.

3) Consider a spherically symmetric charge distribution $\rho=\rho(r)$. By dividing the charge distribution into spherical shells, find the potential and the electric field strength in terms of $\rho(r)$ (write down the potential and the field in the form of an integral with respect to *r*).

4) A line conductor of length L and total charge Q lies on the x-axis with one end on the origin. Find the electric potential and the electric field and any point on the x-axis for x > L.

5) Two infinite parallel plates separated by a distance s are at the potentials 'zero' and V_0.

a) Use Poisson's equation to find the potential in the region between the plates where the space charge density ρ is a linear function of x – for instance $\rho(x) = \rho_o \cdot \frac{x}{s}$

The distance is measured from the plate at 'zero' potential.

b) Find the surface charge densities on the plates.