# Rutgers Physics 385 Electromagnetism I (Fall'15/Gershtein)

Class Exam - October 20, 2015

This is a closed book/notes exam. A one-sided 8.5x11 sheet with only formulae is allowed. Please attach the sheet to your solutions. Calculators are not needed. Exam duration - 1hr 20min. Solve THREE out of four problems below **and indicate which ones are to be graded**

1. A dielectric is shaped like a spherical shell with inner radius R_1 and outer radius R_2. The dielectric carries uniform charge density ρ (see figure). Determine the electric field and potential everywhere (i.e. for $0 < r < \infty$). **Make a sketch of both** as a function of distance from the center.
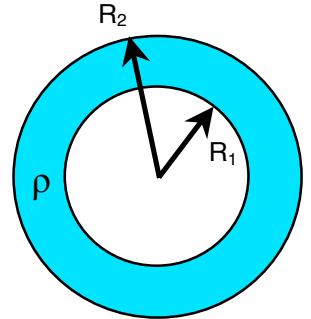
2. A circular loop of wire (radius r) carries linear charge density λ (see figure). Find the potential of the electric filed of the loop at a point z on the z-axis. Use infinity as a reference point. *(hint: think before you rush to integrate!)*
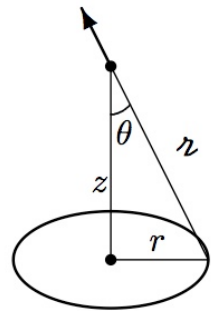
3. Find the energy stored in a spherical capacitor (inner radius R_1, outer radius R_2, charge Q) at least two different ways, e.g. integrate $(\varepsilon_0/2)E^2$, or bring the charge by bits from one plate to the other, or calculate $(1/2)CV^2$, etc.

4. For a vector field $\vec{A} = xy \cdot \hat{x} + 2yz \cdot \hat{y} - 3zx \cdot \hat{z}$ find:
   - divergence of $\vec{A}$
   - curl of $\vec{A}$
   - flux of curl of $\vec{A}$ through the triangle with vertices at (0,0,0), (0,3,0), and (0,0,3)
   - line integral of $\vec{A}$ along the boundary of the same triangle