Physics 322, Winter Quarter 2016
Electrodynamics: Homework Assignment 2
(a) Turn in all problems and clearly note all constants and assumptions you use.
(1-point penalty each otherwise)
(b) Use 8½ x 11 paper & staple
(1-point penalty each otherwise)
(c) Due January 21 either 9:00 am in class or 8:45 am in the instructor's mailbox

1. A vector potential for the infinite solenoid was found in Griffiths example 5.12. a. Demonstrate this potential satisfies the Coulomb gauge condition (Griffiths equation 5.63). b. Show this potential gives the expected inside and outside magnetic fields.

2. Consider an infinitely long cylinder of radius R with a permanent polarization in the radial direction from the cylinder axis (not radial from a point) The magnitude of the polarization is $P_0 r$ with P_0 a constant and r the distance from the axis. a. Find the bound surface and volume charges. b. Find the electric fields inside and outside the cylinder. c. Now rotate the cylinder about its axis at constant angular velocity ω. Find the magnetic field inside and outside the cylinder. (This isn't a radiation problem: that is, we have $\omega R << c$).

3. Consider the torroid of Griffiths example 5.10. Now fill the torroid with a material having permeability μ. Find the magnetization **M** inside and outside the torroid.

4. A “C” magnet consists of iron ($\mu \approx 2500\ \mu_0$) stock with square cross section, and bent into a “C” so there’s a small gap *d*, as shown. You, the magnet designer, need a 100 Gauss field in the gap. The current is 1 Ampere, the square cross section A is 7 cm × 7 cm, the overall size L is 20 cm, the gap is 2 cm. How many wire turns N do you need?