PHYS 4392
Fall 2014
TE Coan
Due: 31 Nov '14 6:00 pm

Homework 9

1. Read Griffiths example problem 5.6. Now consider 2 identical, concentric loops of radius a separated by a distance l and each carrying a current I in the same direction (either clockwise or counter-clockwise). We want to produce a coaxial **B** field that is as uniform as possible at the exact mid-point between the two coils.

a) How far apart L should the coils be? Express your answer as a multiple of a. That is, your answer should be of the form $L = \alpha a$, where α is to be determined.

b) If the midpoint between the coils is labeled the origin, what is $B_z(0)$ for the choice of separation found in part a? Here, the z-direction is the axis of symmetry of the coil pair.

2. Consider a solenoid of length L_0. Recall from PHYS 1304 that the **B**-field well inside the solenoid is parallel to the solenoid's symmetry axis. A particle with speed v and electrical charge $+q$ enters the solenoid at an angle θ with respect to the solenoid axis. For the motion fully inside the solenoid, what is the total path length L traveled by the particle? Ignore edge effects and assume that the particle's orbital radius is less than the radius of the solenoid so the particle it doesn't smack into the solenoid walls.

3. Here is a blast from the past that tests your powers of observation and analysis. Estimate the charge Q carried by the dome of the van de Graaff generator I brought to class. Recall you saw it spark to my hand. (The human body is somewhat conductive.) Take it from there.