Physics 182 Spring 2013

Lab 6 Mapping magnetic fields
Part 2 Final report

Lab group: _____ ***Members:*** _____

Make magnetic field measurements for the circuits, referring to the lab handout for the details.

- Use the peak-to-peak induced voltage as a measurement proportional to the magnetic field component.
- A small sketch of the geometry is needed to describe exactly what you measured.

Make sure you measure the magnetic field component that is requested! The measured magnetic field component depends on the Faraday probe and on how you hold it.

1) Current loop

- Draw a sketch of what you think the field lines may look like so that you have some idea what direction to measure the field in.
- Which of the two Faraday probes are you using for this measurement?
- Take data for the magnetic field along the axis of the coil (z-direction), perpendicular to the plane of the coil (r, theta plane) and fill in the table below. Indicate which point corresponds to the geometric centre of the coil (r=0,z=0). You may find it useful to go in both directions.

z (cm)													
E (mV)													

- Make a graph of the magnetic field as a function of z.
- Think about uncertainties and other effects that contaminate your data for the magnetic field. What is your estimate of how well you know the position z, and the field B (in units of milliVolts)
- Does the magnetic field follow a functional form that you can deduce from the data?
    - Show a fit that demonstrates this form
    - Replot the data in a way that demonstrates this form

  In doing this convincingly, you will have to consider your estimates of uncertainty as well

- Find the magnetic field at a few other points, in the plane of the coil. i.e. z=0. Does this agree with the sketch you started with

2) Solenoid

- Attach your graph of B_x *vs* x, for $x > 0$, where x is the distance along the solenoid axis from the center. On your graph, indicate
  (a) the physical end of the solenoid,
  (b) the point at which B_x falls to 90% of the value at the center, and
  (c) the point where B_x is equal to 50% of the value at the center.
- Comment on your observations of $B_x(x=0)$ *vs* r both inside and outside the coil.

- Where do you find the largest value of B_r? (Use a sketch if convenient.)

- What do you find for B_r inside the coil? (Use a sketch if convenient.)
  How does the magnitude compare with $B_x(x=0)$? How did you make this comparison?

3) "Infinitely" long straight conductor

- Be careful to keep the unshielded wires away from the probe coil.

- ***Measure*** the tangential field *vs r* and ***plot*** *B* as a function of r. You don't need to use exactly the values of r below, these are just suggestions.

R (wire) =_____ R (probe) =_____ ***r* (min)** = R (wire) + R (probe) = _____

Target r (cm)	***r* (min)**	1.0	1.25	1.5	2.0	2.5	3.0	4.0	5.0	10.0	20.0
Actual r (cm)											
1/*r* (cm^{-1})											
E (mV)											

- Please upload E(mV) versus actual r (cm)
- What do you think the functional dependence of B on r is? Plot the graph above differently in order to test your guess.

- What did you learn about the other components of **B**, *i.e.*, the radial component and the component that is parallel to the conductor? Is this what you expect?

- Why were you cautioned to keep the unshielded wires away from the probe coil?