ENSC 220 Lab #3 RL & RC circuits Coil Winding Notes

1.0 Materials supplied in this bag, for coil winding

1.1 Core, 1 of: 6 inch (15 cm) piece of nominal 3/4" (20 mm) PVC Schedule 40 pipe with an outside diameter (O.D.) of 1 1/16 inch

1.2 Wire, 1 coil of: #26 AWG enamelled wire, approximately 70 feet in length

1.3 Fine sandpaper for removing enamel insulation from wire

2.0 General comments

2.1 *For your own sake, read this entire handout carefully, before starting your coil.*
2.2 Each group will sign out one bag of materials and will wind one inductor per group.
2.3 These are the only materials that will be issued. There will be no additions or replacements.
2.4 This inductor will be used in more than one lab.
2.5 Follow the winding tips below and you should have minimal trouble. This is not a 5 minute job, however. Be sure to allow plenty of time.
2.6 Should you break the wire, or tangle it up, you should be able to recover. A little patience should allow you to untangle most knots. If you break the wire, you should be able to solder it (see 5.10 below). In the worst case, you may have to cut off a tangle and wind a slightly shorter coil. Throwing everything behind the lab bench and asking for more is not an option. You may go elsewhere (e.g., Radio Shack) and buy more wire if you like, but this is inconvenient for you and should not be necessary.

3.0 Equipment and materials available in lab, to be shared

3.1 Soldering iron and solder
3.2 Masking tape

4.0 Other materials, coil or capacitor

4.1 You can make capacitors from anything you want. We will supply aluminium foil and plastic wrap in the lab, as possible capacitor construction materials.
4.2 If you need anything else, for either coil or capacitor, you're on your own.

5.0 Winding hints:

5.1 Do not leave this job until the last minute, and do not start it unless you have time to give it some attention. It is better to work out a winding technique and complete the job in one sitting.

5.2 Fine wire is easily kinked and broken. Be careful. If you do knot it up, however, it can be untangled, carefully.

5.3 Soft copper will work harden and break if bent at the same spot too many times or twisted too tightly.

5.4 Wind a tapped inductor with about the same number of taps as shown in the diagram in the lab write-up. Using many more or less taps will only cause problems either in winding or in the subsequent application.

5.5 While the "sliding contact" style inductor is fine in theory, it is not simple to make a reliable one, and we do not have the materials to make this a trivial item to construct. Just be aware of this method of creating a variable inductor but don't try to make it; stick to the tapped version.

5.6 When winding the inductor, try to avoid handling the wire a lot. You'll spend all your time undoing knots and kinks. Winding is a task you want to do only once.

5.7 Unwind about a metre of the supplied wire; leave the rest coiled for now. You may want to experiment with removing the enamel from the end of the wire with the sandpaper. You should also try a few trial turns on the core. Once you have a method that works, settle down and wind the whole coil at once if possible.

5.8 While one person can wind the coil, it might be useful to come up with a technique such that one person winds the coil while another carefully feeds the wire, avoiding damage and knots. Some possible methods:

> **5.8.1** Preferred: Get a partner to maintain tension on the wire while you hold the pipe ends and rotate it. Every few turns push the turns together neatly. Get a third partner to uncoil the wire and feed the "tensioner". This method results in very few kinks and goes fairly quickly once you get good at it.
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> **5.8.2** Not bad: Hold one end of the pipe and wrap wire around it. It is still handy to have someone uncoiling the wire for you. Kinks are common and it's easy to drop the whole thing and have to start over.
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> **5.8.3** Not good: Trying to do it all yourself, unless you are really co-ordinated and have done similar work in the past.

5.9 Windings should be neatly and tightly spaced adjacent to one another. Do not scramble wind turns over one another. While you want the coil to be wound as neatly as possible, however, neither performance nor marks are going to suffer from a few loose or crossed windings; do not start over again because you cross a couple of windings. Tape them in place and keep going.

5.10 If you break the wire at any time, merely clean and tin the ends as mentioned below and solder them together. Do not throw out the whole coil, unless you are going to buy more wire yourself.

5.11 Counting the turns after completing the inductor is easier than trying to keep track while winding. Just use a pointed but non-scratchy item (e.g., toothpick, mechanical pencil with lead extended) and drag it over the coil, counting the bumps as you go. If you do it slowly and repeat the measurement a few times you will get a good result.

5.12 Hold the start winding of your coil in place with tape.

5.13 Twist the taps as shown, but do not make them so tight that they break.

5.14 Hold each tap in place with tape.

5.15 You may find it useful to mark the total number of turns at each tap, along with the number of turns between each pair of taps. Write it on the tape holding the taps and end wires in place.

5.16 Hold the last winding of your coil in place with tape.

5.17 Use fine sandpaper to remove the enamel insulation at the end of the taps and at both ends of your inductor wire. Be careful with this fragile wire.

5.18 Use the soldering iron and solder to tin the areas where you have removed the insulation. If you cannot get a good coat of solder on these points, there is still enamel remaining. Use the sandpaper again and repeat until these points are well tinned. Remember that no solder = enamel = no electrical connection.

5.19 It may be useful to solder lengths of wire (about 15 cm long) to each tap so that the taps can be checked on the bridge and inserted into your breadboard more easily.