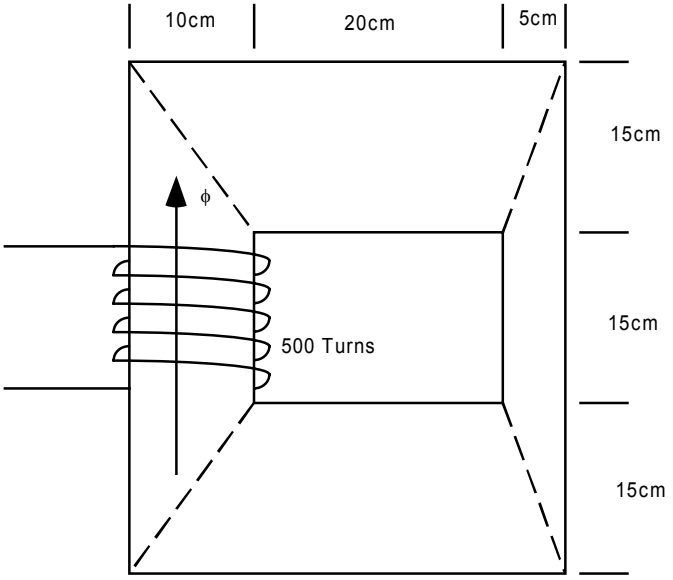
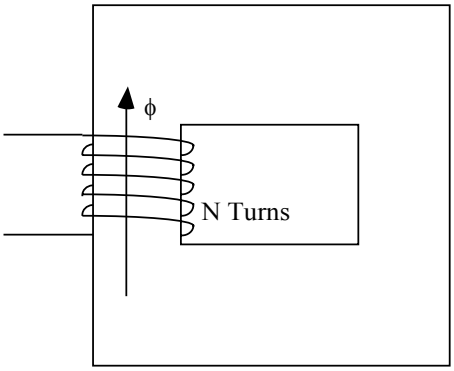
ECE 320: Homework #4

DUE DATE: By 5:00pm on Wednesday October 8.

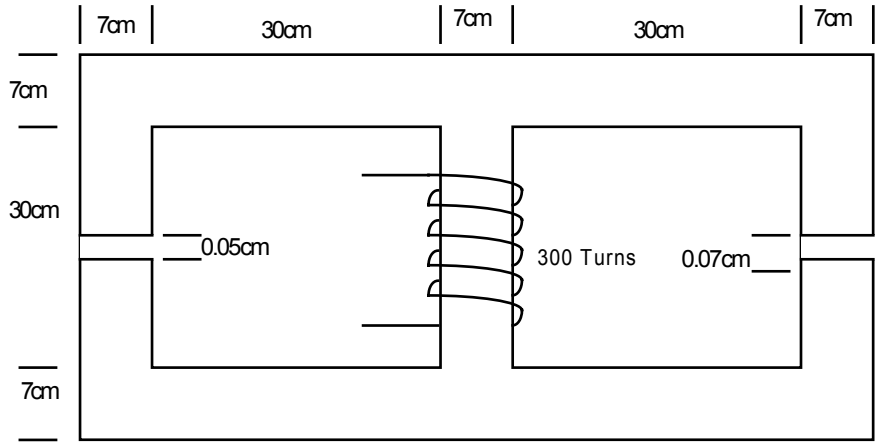
1. A ferromagnetic core is shown in the Figure below. The depth of the core is 5cm. The other dimensions of the core are as shown in the figure. Calculate the reluctances of the core (there will be more than one) and sketch the magnetic circuit. Then calculate the value of the current that will produce a flux of 0.003Wb.With this current, what is the flux density at the top of the core? What is flux density at the right side of the core? Assume that the relative permeability of the core is 1000.



2. You need an inductor with an inductance of 3.3 mH. You are not able to purchase one, so you will wind it yourself. You have a closed core with a cross sectional area, A=0.03501 m^2, and a mean path length *lc* = 1.2m, and a relative permeability of 2500. How many turns do you need to wind around the core?



3. A ferromagnetic core with a relative permeability of 2000 is shown in the Figure below. The dimensions are as shown in the diagram, and the depth of the core is 7cm. The air gaps on the left and right sides of the core are 0.050 and 0.070 cm, respectively. Because of fringing effects, the effective area of the air gaps is 5 percent larger than their physical size. There are 300 turns in the coil wrapped around the center leg of the core and if the current in the coil is 1.0A. Calculate reluctance values and sketch the magnetic circuit for this case. Calculate the flux in each of the left, center, and right legs of the core. What is flux density in each air gap?



4. A core with three legs is shown on the next page. Its depth is 8cm, there are 400 turns on the center leg. The remaining dimensions are shown in the figure. The core is composed of steel having the magnetization curve shown next to the core. Answer the following questions about this core:

(a) What is the current required to produce a flux density of 0.5 T in the central leg of the core?

(b) What is the current required to produce a flux density of 1.0 T in the central leg of the core? Is it twice the current in part a?

(c) What are the reluctances of the central and right legs of the core under the conditions of part a?

(d) What are the reluctances of the central and right legs of the core under the conditions of part b?

(e) What conclusion can make about the reluctances in real magnetic cores?