KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

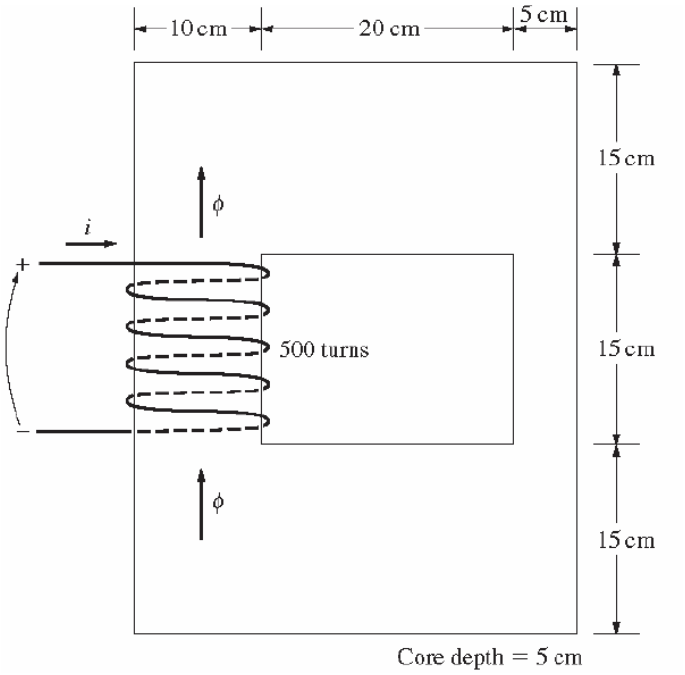
EE 306 – Term 171

HW # 2: Magnetic Circuits

Due Date: October 11th, 2017

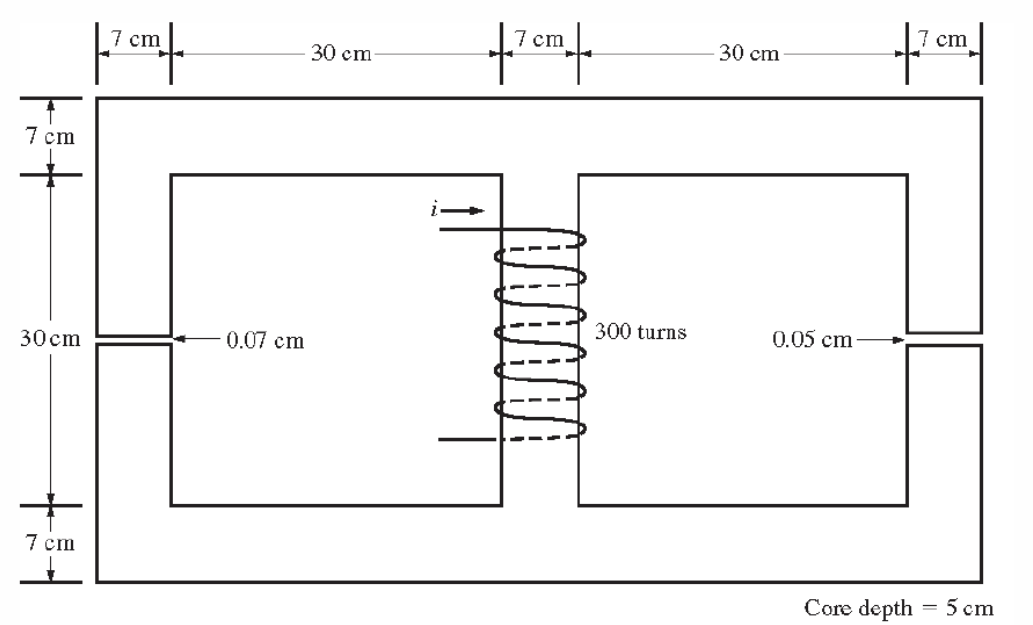
Problem # 1:

A ferromagnetic core is shown below. The depth of the core is 5 cm. The other dimensions of the core are as shown in the figure. Find the value of the current that will produce a flux of 0.005 Wb. With this current, what is the flux density at the top of the core? What is the flux density at the right side of the core? Assume that the relative permeability of the core is 800.



Problem # 2:

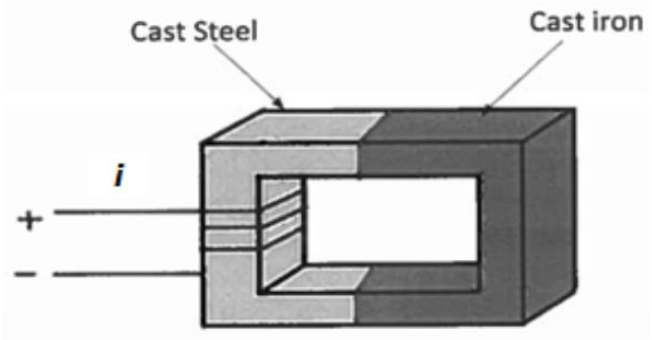
A ferromagnetic core with a relative permeability of 1500 is shown below. The dimensions are as shown in the diagram, and the depth of the core is 5 cm. The air gaps on the left and right sides of the core are 0.050 and 0.070 cm, respectively. Because of fringing effects, the effective area of the air gaps is 5 percent larger than their physical size. If there are 300 turns in the coil wrapped around the center leg of the core and if the current in the coil is 1.0 A, what is the flux in each of the left, center, and right legs of the core? What is the flux density in each air gap?



Problem # 43

Consider a magnetic circuit as shown below. The core of the circuit is composed of cast steel and cast iron. Each material has a mean length of 20 cm. The cross section area of the core is 16 cm^2. The coil has 350 turns and it carries a current of 1.2 A. The relative permeability of the cast steel is 800 and that of cast iron is 250. Determine the following:

1) The flux in the core
2) The total flux linkage
3) The magnetic flux density B in the core



Problem # 4:

A square magnetic core has a mean path length of 55 cm and a cross-sectional area of 150 cm^2. A 200-turn coil of wire is wrapped around one leg of the core. The magnetization curve of the core material is shown below.

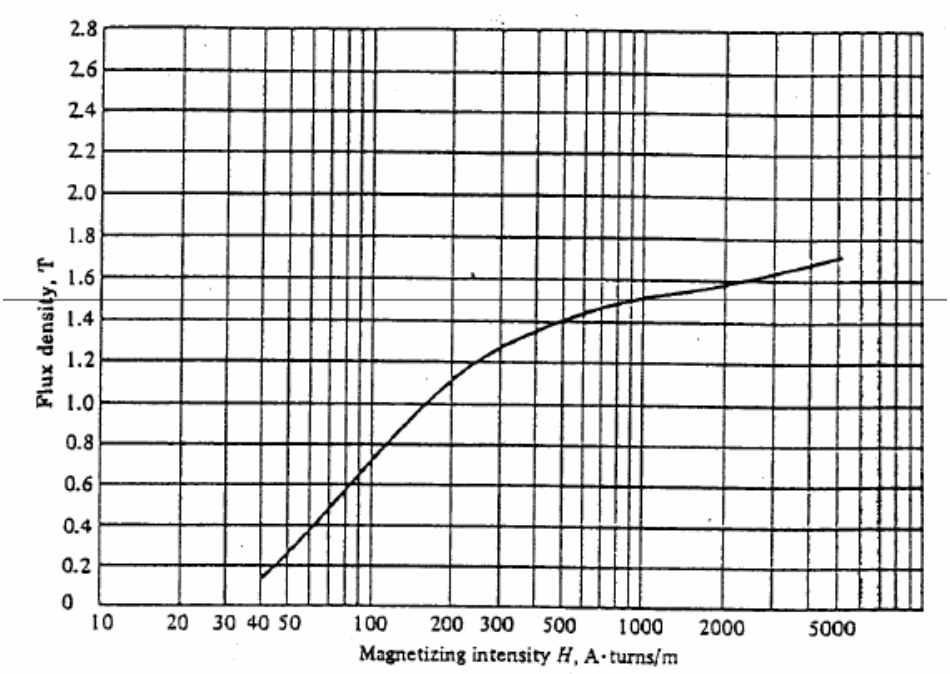
(a) How much current is required to produce 12 mWb of flux in the core?

(b) What is the relative permeability of the core at that level of current?

(c) What is its reluctance?

(d) Repeat part (a) if an air-gap of length 1 mm is cut across the core.

Assume a 5% increase in the effective air-gap area to account for fringing.



Problem # 5:

The total core loss for a specimen of magnetic sheet steel is found to be 1800 W at 60 Hz. If the flux density is kept constant and the frequency of the supply increases 50%, the total core loss is found to be 3000 W. Compute the separate hysteresis and eddy-current losses at both frequencies.