

ECE 331 - Homework #3

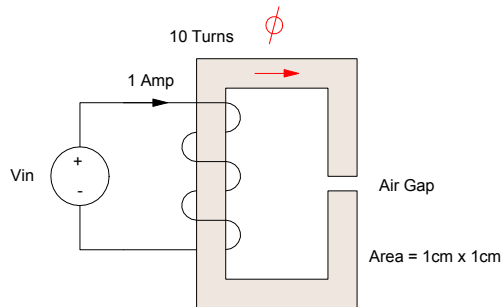
Maxwell's Equations, Magnetic Circuits, Inductors. Due Monday, February 3rd, 4PM

1) A rail gun is to accelerate a penny with a force of 1000 m/s². Specify the current and magnetic field strength required.

2) Design a circuit (number of windings, current) to provide the magnetic field you specified in problem #1. Assume an area of 1cm x 1cm.

3) The following circuit is used to generate a magnetic field across a 5mm air gap. Determine the flux density assuming

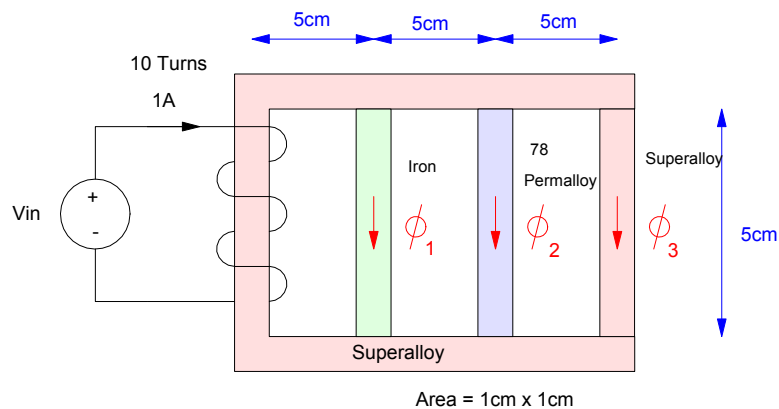
- The cross sectional area is 1cm x 1cm
- Each portion of the core has a length of 5cm
- The relative permeability of the core is 8,000



4) Determine the flux if the air gap is reduced to 0.1mm

5) Determine the flux $\phi_1 \dots \phi_3$. Assume the relative permeabilities are

- Iron: 200
- 78 Permalloy: 8,000
- Superalloy: 100,000



Problem 6-7) Determine a RL series and parallel model for a device with the following data:

Problem 6)

- Volts = 120V rms
- Current = 140mA rms
- Power = 1 Watt
- Frequency = 60Hz

Problem 7)

- Volts = 24V rms
- Current = 400 mA rms
- Current lags voltage by 70 degrees

Bonus! What percentage of the electricity produced in the U.S. comes from coal?