ECE 207 Lab Work 4 Due September 23rd

Names _____

Objective: To understand electromagnets and to use the resulting forces and torques in engineering applications.

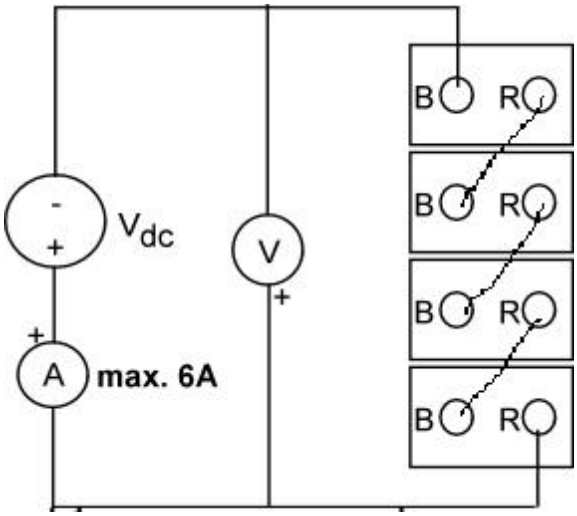
Deliverables

1) Completed procedure.
2) Table of experimental data giving let-go current.
3) Analysis sheets (please attach: well-organized, detailed, and neat), showing i)magnetic circuit, ii)calculation of forces, and iii)FBDs and calculations that allow N, the number of turns, to be extracted using the measured let-go current.

Procedure

Electrical circuit

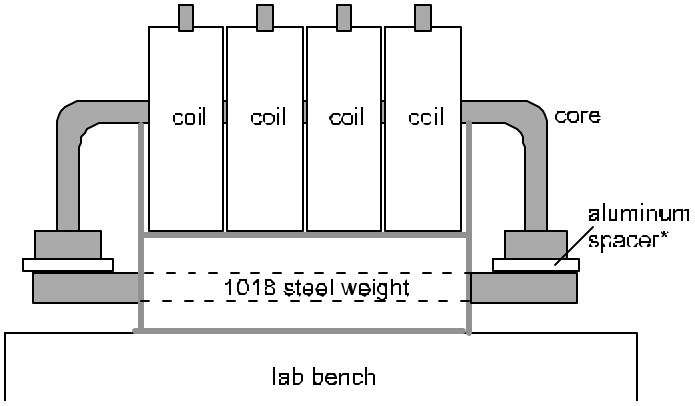
1. Place coils on core if not previously set up. Connect coils as shown below and, **before** turning power on, be sure DC power supply is adjusted for 0V.
2. Adjust DC source so that 3A of current is present.



Placing weight and spacers

3. Place core, coils, weight and aluminum spacers as shown at the top of page 2.
4. *Gradually* reduce current until weight drops. Be careful not to jar the bench as this will cause the weight to drop due to vibration rather than insufficient torques and forces.

5. Repeat step 4 for a total of 10 trials. Use the mean of the 10 trials for the measured let-go current.



*Note that aluminum is nonmagnetic—the aluminum spacers act as air gaps.

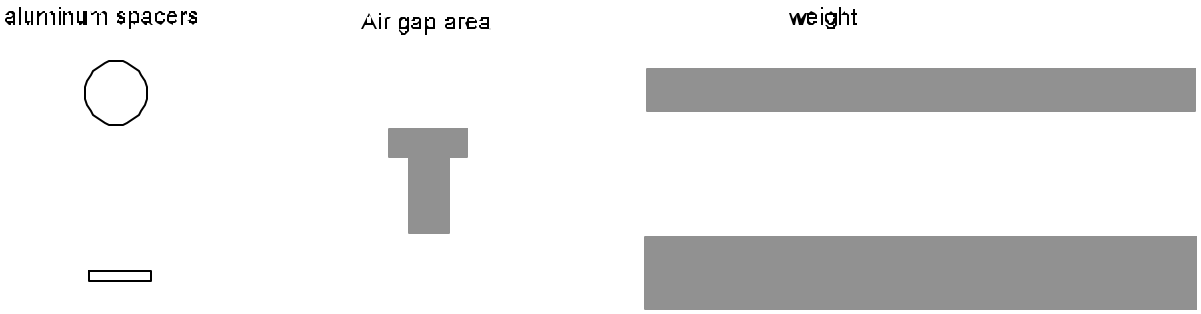
Table of let-go currents for DC trials

trial	1	2	3	4	5	6	7	8	9	10	mean
let-go current (A)											
voltage (V)											

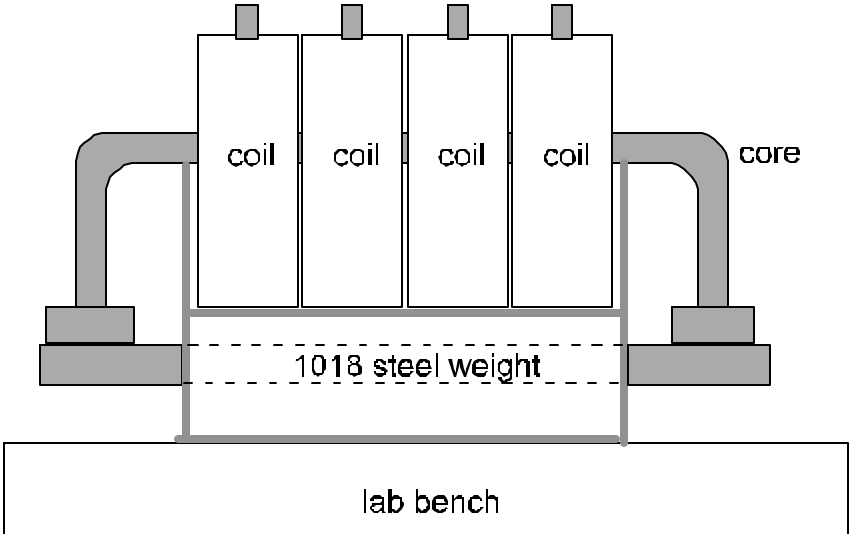
Dimensions for aluminum spacer and 1018 steel weight

6. Using calipers, measure the spacer and weight dimensions. The weight material is 1018 steel (ρ_{st} =). Find

   The spacer material is aluminum (ρ_{al} =).



7. Place magnetic weight, **without** aluminum spacers, as shown below.



8. With the current initially adjusted to 3A, g*radually* reduce the current.
9. **If** the weight drops, record the value of let-go current with no gap.

   $I_{no\ gap}$ = _____

10. **If** the weight does not drop, explain why.

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Analysis

With aluminum spacers in magnetic circuit. Assume the reluctance of the air gaps are much larger than the reluctance of the steel core. From DC let-go current and physical dimensions, determine the total number of turns.