# T.C.

# GEBZE TECHNICAL UNIVERSITY

# PHYSICS DEPARTMENT

## PHYSICS LABORATORY II

## EXPERIMENT REPORT

**THE NAME OF THE EXPERIMENT**

Current Balance



**PREPARED BY**

**NAME AND SURNAME :**

**STUDENT NUMBER :**

**DEPARTMENT :**

**GROUP NO :**

**TEACHING ASSISTANT :**

**DATE OF THE EXPERIMENT : ….. / ….. / …….**

**DATE : ….. / ….. / …….**



Signature:

## Equipments :

- Digital scale
- Current source and ampermeter
- Various-length current circuit
- Magnet set

## Experiment Set:

**Figure 1.** *Current Balance Set*



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## Experimental Procedure:

**A - Change in magnetic force F with Current I**

**1-** Place the magnet set on the scale.

**2-** Select the current loop with the longest length $l$ and record this length.

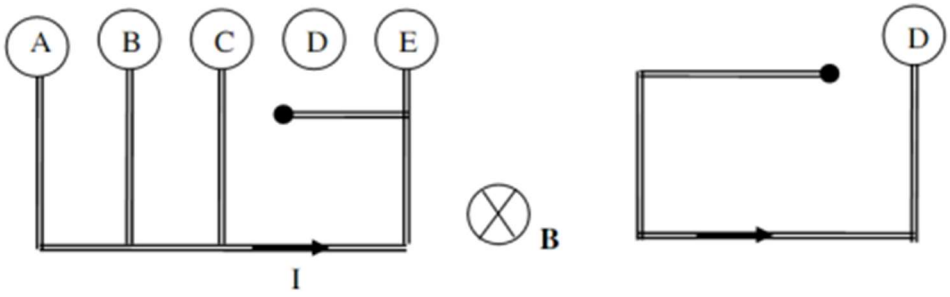


**Figure 2.** Direction of current on the wire and connections.

**3-** Attach the current circuit with the current loops facing downwards to the main module in a way that it extends downwards. Ensure that the circuit surface is facing downward. (Refer to Figure 3).

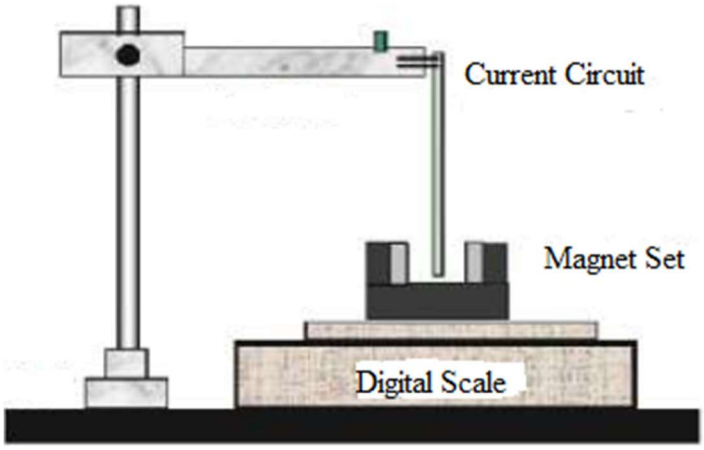


**Figure 3**. *Installation of the Current Balance*

**4-** Place the current circuit on the ground in such a way that its lower part passes between the extending poles.

**5-** Ensure that the elements in the circuit are grouped together in parallel and do not come into contact with the current. Adjust the height of the main module if necessary

**6-** When there is no current in the circuit, press the tare button on the digital scale to display a value of 0.00 grams on the screen.



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**7-** Connect the current source to the circuit as shown in Figure 4.

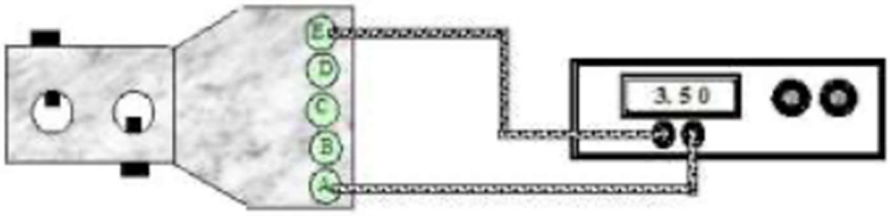


**Figure 4**. *Top view of the main and connection of the current source to the main module*

**8-** Increase the current in the circuit in increments of 0.5 amperes until it reaches a maximum of 4 amperes.

**Note:** Ensuring that the current does not exceed **4A !**

**9-** For each current value, read the new mass of the magnet assembly from the digital scale. If the mass of the magnet assembly decreases as the current increases, it indicates that the direction of the current within the magnetic field is not as shown in Figure 2. In this case, reverse the connections in the main module.

**10-** Record your measurements in Table 2, including the current values and the corresponding mass values read from the digital scale.

**Table 1.** Current loop - Wire length table.

| **Current loop** | **Wire length** |
|---|---|
| AB or BC | 1 unit |
| AC or CE | 2 units |
| BE or ED | 3 units |
| AE | 4 units |
| CD | 5 units |
| BD | 6 units |
| AD | 7 units |



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**Table 2**. *Current values and corresponding mass values read from the digital scale.*

| Number of Measurement | Current ( ) | Mass ( ) |
|---|---|---|
| **1** | | |
| **2** | | |
| **3** | | |
| **4** | | |
| **5** | | |
| **6** | | |
| **7** | | |
| **8** | | |

1) Explain the relationship between weight and gravitational force.

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2) Multiply each mass value read by $\boldsymbol{g = 9.81\ m/s^2}$ So calculate the magnetic force $F$ for each measurement. Write down the intermediate steps.

$F_1 =$ $F_5 =$

$F_2 =$ $F_6 =$

$F_3 =$ $F_7 =$

$F_4 =$ $F_8 =$



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Plot magnetic force *F* (y-axis) vs. current *I* (x-axis) graph

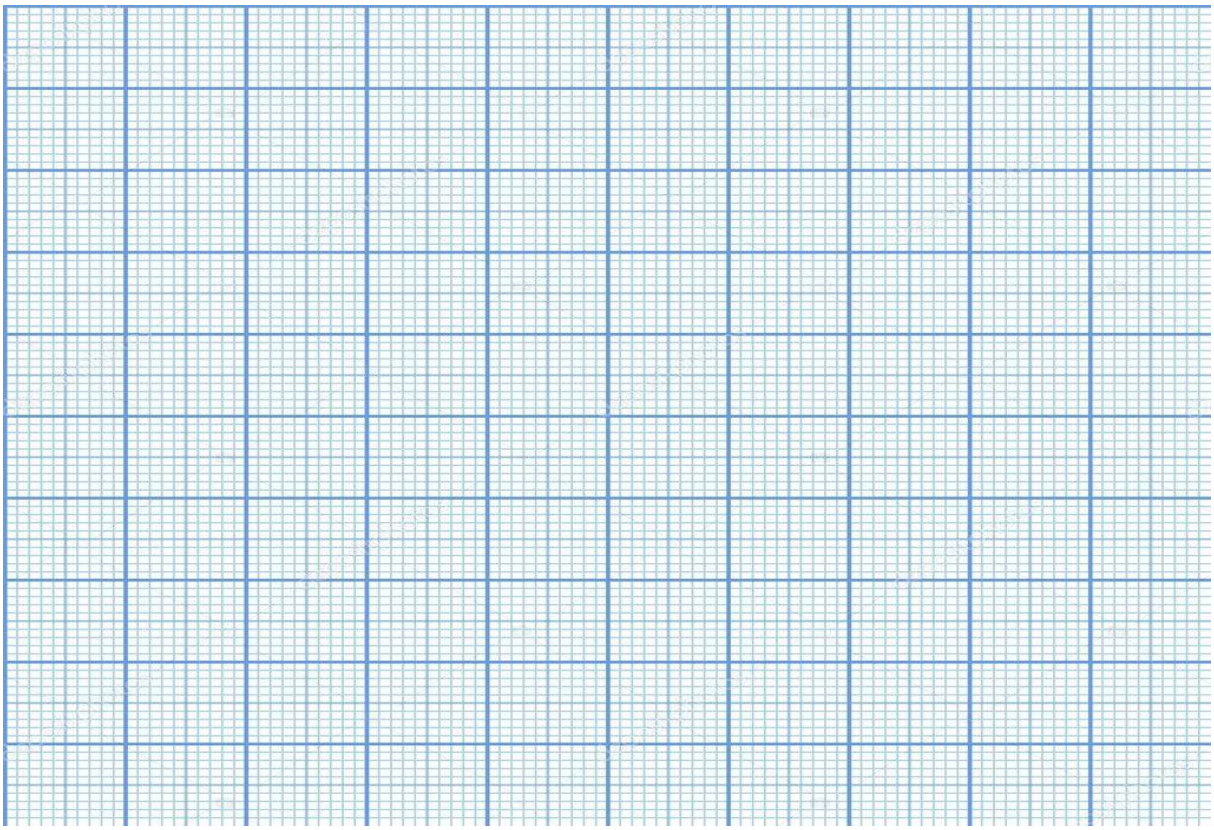

**Figure 5.** *Magnetic Force **F** – Current **I** graphic*

Calculate the slopes m of the lines that fit the data points on your *F* vs. *I* graphs, which are plotted in the previous step. In the following formulae, the $x_i$ 's represent the current *I* while the $y_i$'s represent the magnetic force F. The number of data used in calculations is n.

Write down the intermediate steps.

$$\sum_{i=1}^{n} x_i y_i =$$

$$m = \frac{\sum_{i=1}^{n} x_i y_i}{\sum_{i=1}^{n} x_i^2} =$$

$$\sum_{i=1}^{n} x_i^2 =$$

3) Find the intensity of the magnetic field of the magnet by using the slope of the graph and equation (4). Write down the intermediate steps.



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**B - Change in Magnetic Force with Wire Length**

**1-** Reset the current to zero without disturbing the setup established in the previous section.

**2-** Adjust the wire length to its shortest configuration and connect the current circuit to the main unit.

**3-** Press the tare button on the digital scale to read and display a value of 0.00 grams on the screen.

**4-**Set the current to 3 amperes, then read and record the value indicated by the scale for this wire length.

**5-** Reset the current and disconnect the current source connections from the main unit.

**6-** Repeat steps 3, 4, and 5 for different wire lengths.

**7-** Record the tested lengths of wire and their corresponding mass values in Table 3.

**Table 3**. *The tested wire lengths and their corresponding mass values for the current circuit*.

| **Number of Measurement** | **Length** ( ) | **Mass** ( ) |
|---|---|---|
| **1** | | |
| **2** | | |
| **3** | | |
| **4** | | |

4) Multiply each mass value read by $\boldsymbol{g = 9.81\ m/s^2}$ So calculate the magnetic force $F$ for each measurement. Write down the intermediate steps.

$F_1 =$ $F_5 =$

$F_2 =$ $F_6 =$

$F_3 =$ $F_7 =$

$F_4 =$ $F_8 =$



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Plot magnetic force $F$ (y-axis) vs. wire lengths $l$ (x-axis) graph

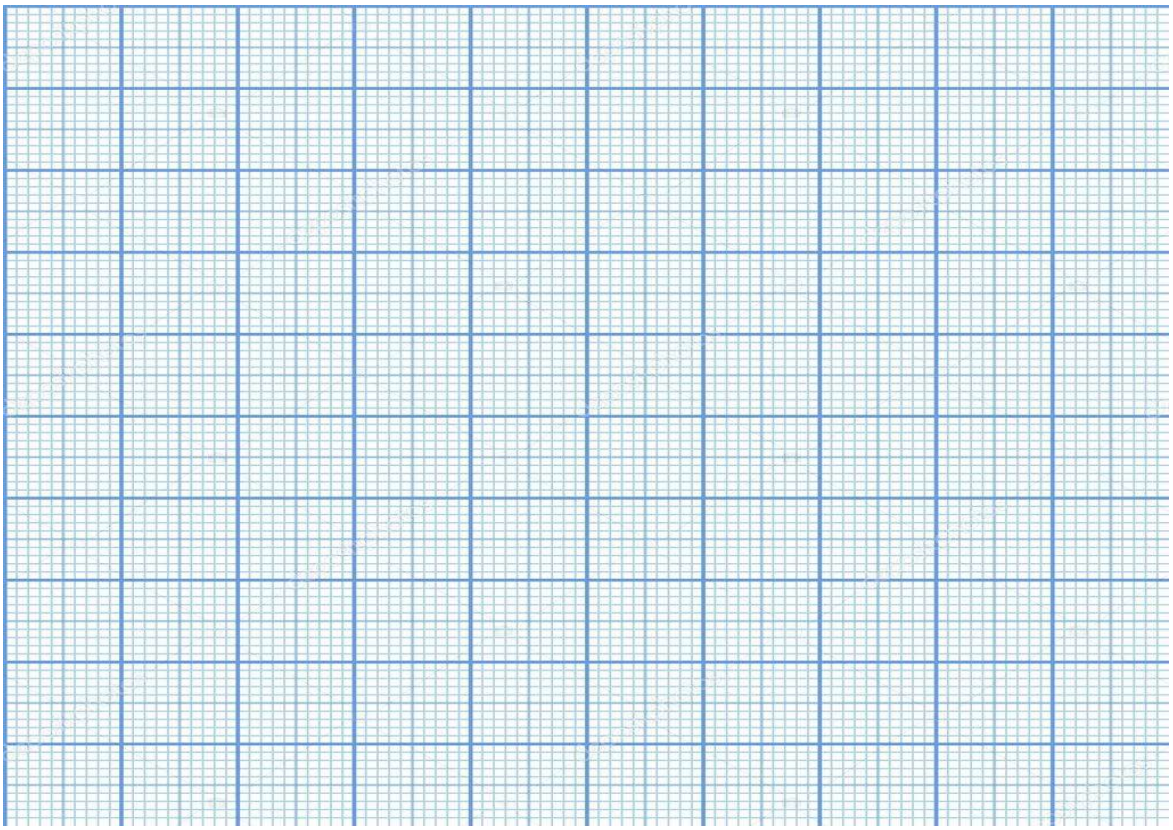

**Figure 5.** *Magnetic Force **F** – Wire lengths **l** graphic*

Calculate the slopes m of the lines that fit the data points on your $F$ vs. $l$ graphs, which are plotted in the previous step. In the following formulae, the $x_i$ 's represent the wire lengths $l$ while the $y_i$'s represent the magnetic force F. The number of data used in calculations is n.

Write down the intermediate steps.

$$\sum_{i=1}^{n} x_i y_i =$$

$$m = \frac{\sum_{i=1}^{n} x_i y_i}{\sum_{i=1}^{n} x_i^2} =$$

$$\sum_{i=1}^{n} x_i^2 =$$

5) Find the intensity of the magnetic field of the magnet by using the slope of the graph and equation (4). Write down the intermediate steps.



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## Conclusion, Comment and Discussion:

(**Tips**: Give detail explanation about what you've learned in the experiment and also explain the possible errors and their reasons.)

-Give detail explanation about what you've learned in the experiment

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-Explain the possible errors and their reasons in the experiment

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## Questions:

**Q1)** Calculate the magnetic field **B** created 1 cm away from the charging cable with 1 mA current flowing through it.

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**Q2)** Calculate the magnetic force exerted on each of the two parallel charging cables, each carrying 1 mA of current, with a length of 20 cm and a separation of 1 cm between them.

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**Q3)** Write 3 examples of the use of magnetic force in daily life and explain briefly.

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