Lab Group		***Students who hand in the report***	***Control Stamp***
Session Date			
Deadline			

MAGNETIC FIELD CREATED BY SIMPLE CIRCUITS

Note:

- ***Include all units and uncertainties of the measurements in the tables.***
- ***The lines of best fit by least squares should be drawn in the same plot as the experimental points***

5.1 Measure the magnetic field at the center of a loop.

5.1.2 Calibration of the teslameter.

After zero adjustment, the final measurement of teslameter is:

$$B_0 = \quad \pm \quad \text{(mT)}$$

5.1.3 Measure the magnetic field at the center of a loop.

The measurement of the magnetic field B for the loop of radius 6 cm and N = 3 is done in section 5.1.4.

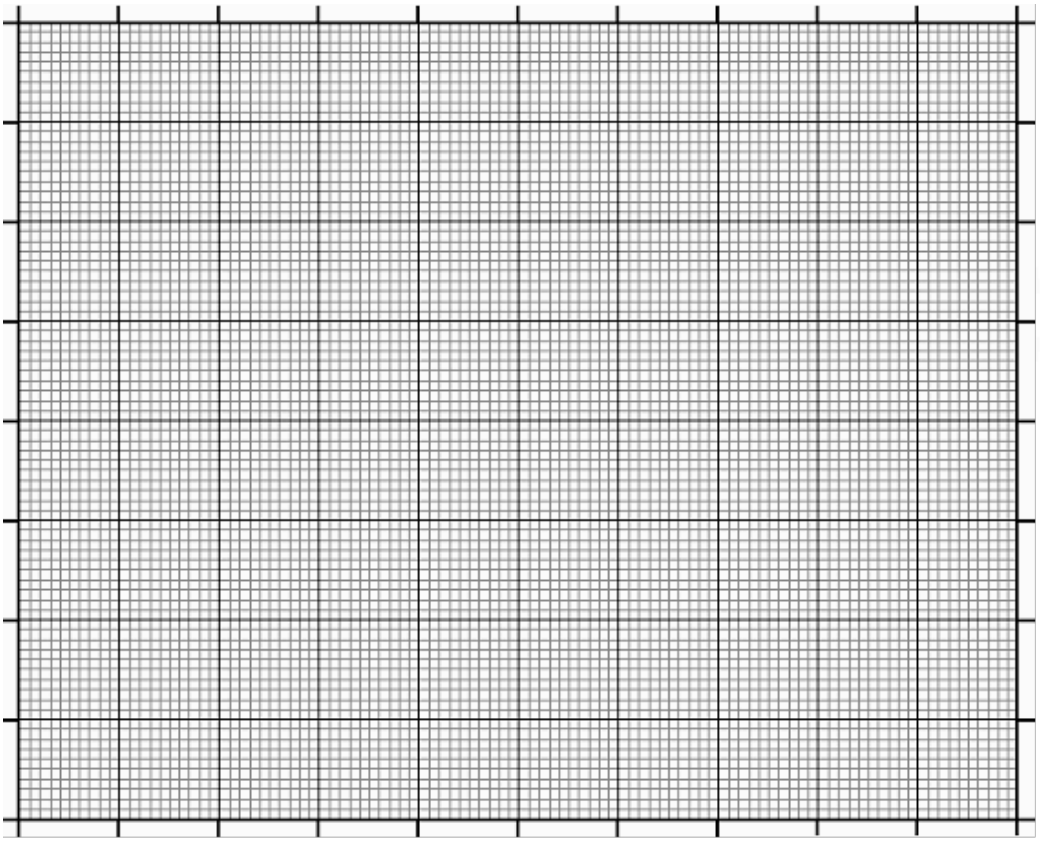
5.1.4 Study of the dependence of B with the number of loops.

Radio R (m)	0.06

Current I (A)	

Number of turns (N)	**B_1**	**B_1-B_0**	**B_2**	**B_2-B_0**	**Average value of B**
1					
2					
3					

Plot B – N



- **Least-squares line fit of the variable y = B with respect to x = N.**

$\sum x_i$	=
$\sum y_i$	=
$\sum x_i y_i$	=
$\sum x_i^2$	=
n	=
σ	=

Results of the least squares fit.

- Slope:

m = Δm =

m = ± ( )

- Intercept.

$b =$ $\Delta b =$

b = ± ( )

• Interpret the values of the fitting parameters, using equation [5].

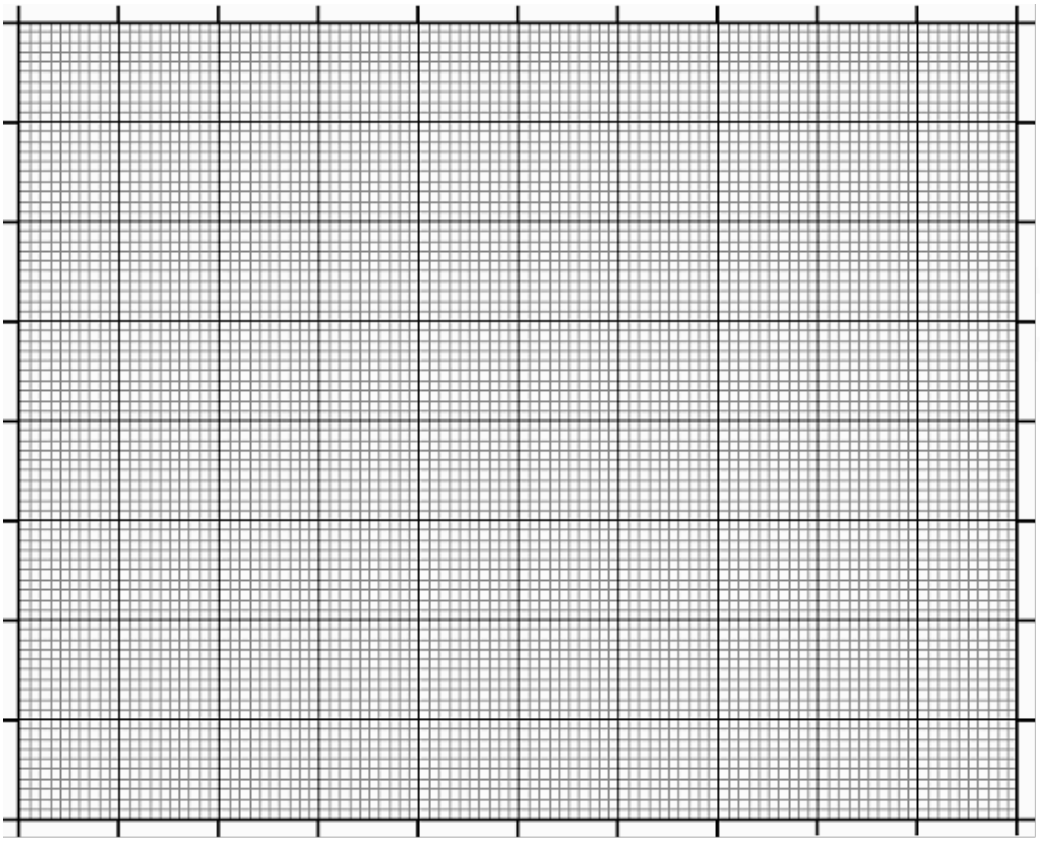
5.1.5 Study of the dependence of B with the radius of the turns.

Number of turns N	1

Current I (A)	

Radio (m)	**B_1**	**B_1-B_0**	**B_2**	**B_2-B_0**	**Average value of B**	**Ln (B)**	**Ln (R)**
0.03							
0.042							
0.06							

Plot Ln (B) – Ln (R)



- **Least-squares line fit of the variable y = Ln (B) with respect to x = Ln (R).**

$\sum x_i$	=
$\sum y_i$	=
$\sum x_i y_i$	=
$\sum x_i^2$	=
n	=
σ	=

Results of the least squares fit.

- Slope:

m = Δm =

m = ± ( )

- Intercept:

b = Δb =

b = ± ( )

• Interpret the values of the fitting parameters, using equation **[5]**.

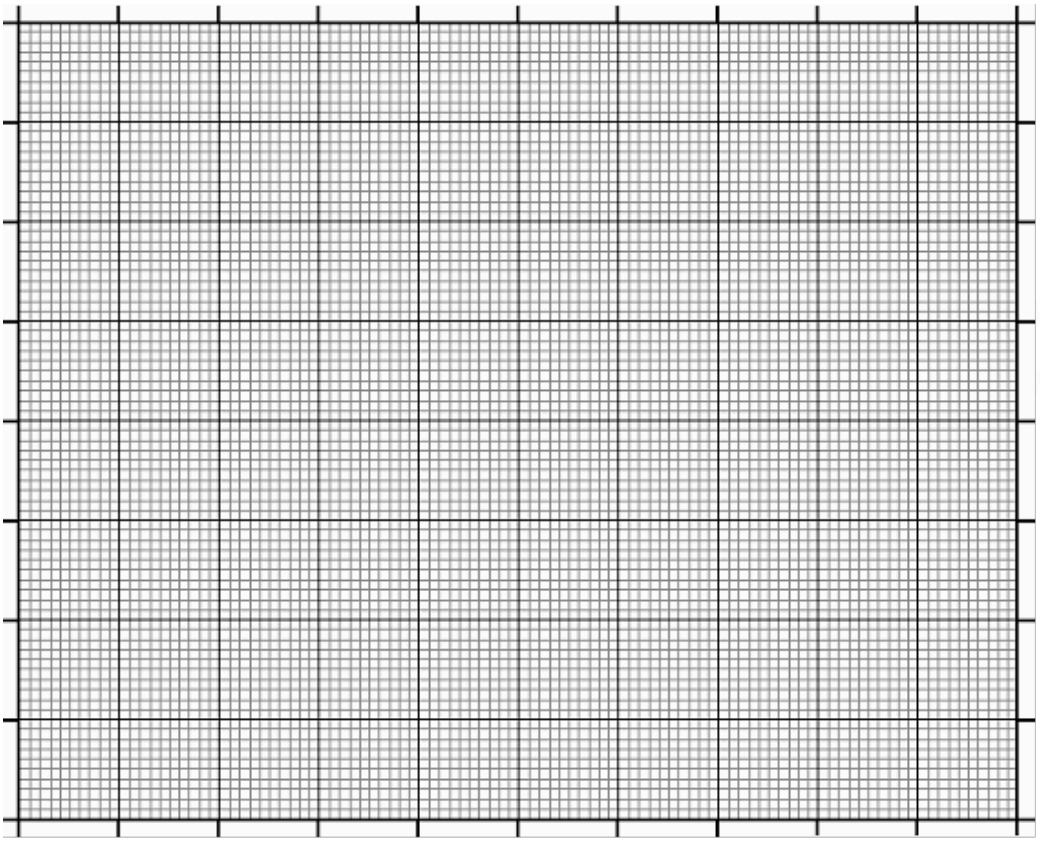
5.1.6 Study of the dependence of B with the current intensity.

Radius R (m)	0.06

Number of turns N	3

Current I (A)	**B_1**	**B_1-B_0**	**B_2**	**B_2 -B_0**	**Average value of B (T)**

Plot B – I.



- **Least-squares line fit of the variable y = B with respect to x = I.**

$\sum x_i$	=
$\sum y_i$	=
$\sum x_i y_i$	=
$\sum x_i^2$	=
n	=
σ	=

Results of the least squares fit.

- Slope:

m = Δm =

m = ± ( )

- Intercept:

$b =$ $\Delta b =$

b = ± ( )

• Interpret the values of the fitting parameters, using equation **[5]**.

• Determine the value of the magnetic permeability of free space μ_0 using the interpretation made in the previous step. Compare the result with the theoretical value given in equation [2].

5.2 Measurement of the magnetic field in the axis of a solenoid.

5.2.1 Calibration of the teslameter.
After zero adjustment, the final measurement of teslameter is:

$$B_0 = \quad \pm \quad (mT)$$

5.2.1 Solenoid with 150 loops.

Current I (A)	

Position x (m)	B_1	B_1-B_0
0		

Position x (m)	B_1	B_1-B_0
0.01		
0.02		
0.03		
0.04		
0.05		
0.06		
0.07		
0.08		
0.09		
0.10		
0.11		
0.12		
0.13		
0.14		
0.15		

Position x (m)	B_1	B_1-B_0
- 0.01		
- 0.02		
- 0.03		
- 0.04		
- 0.05		
- 0.06		
- 0.07		
- 0.08		
- 0.09		
- 0.10		
- 0.11		
- 0.12		
- 0.13		
- 0.14		
- 0.15		

5.2.2 Solenoid of 75 loops.

Current I (A)	

Position x (m)	B_1	B_1-B_0
0		

Position x (m)	B_1	B_1-B_0
0.01		
0.02		
0.03		
0.04		
0.05		
0.06		
0.07		
0.08		
0.09		
0.10		
0.11		
0.12		
0.13		
0.14		
0.15		

Position x (m)	B_1	B_1-B_0
- 0.01		
- 0.02		
- 0.03		
- 0.04		
- 0.05		
- 0.06		
- 0.07		
- 0.08		
- 0.09		
- 0.10		
- 0.11		
- 0.12		
- 0.13		
- 0.14		
- 0.15		

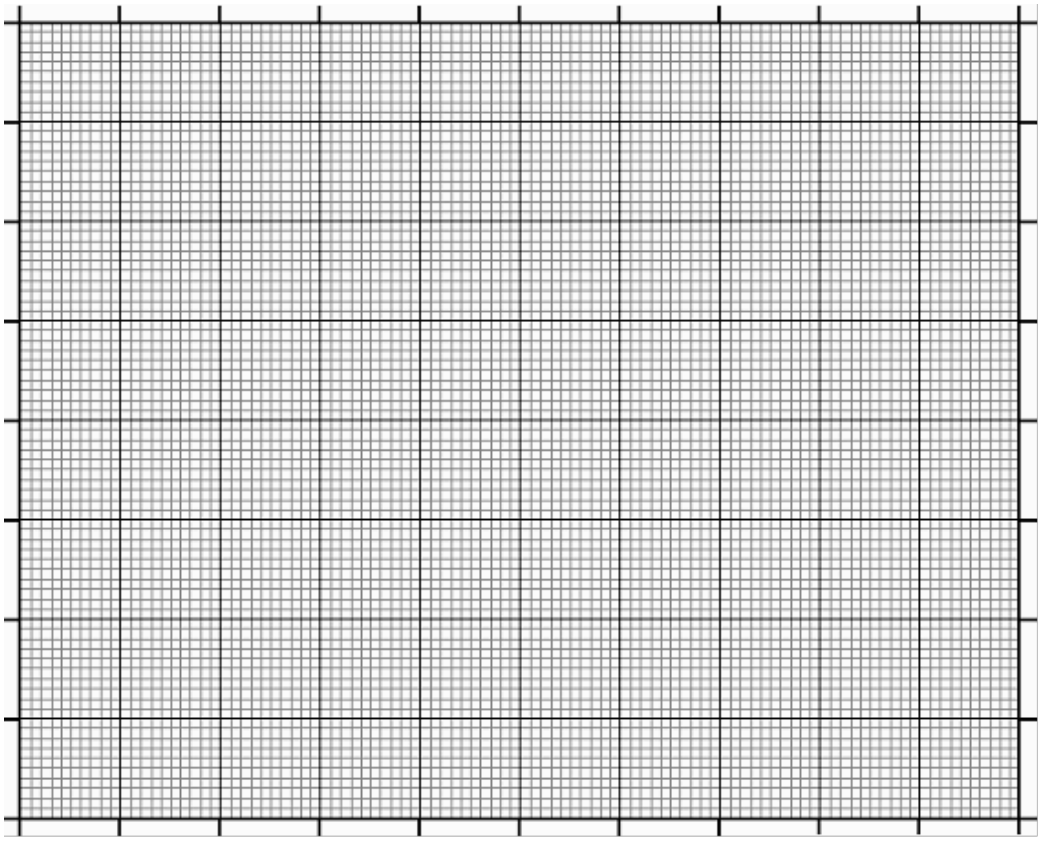
5.2.3 Questions.

• Theoretical values (obtained from equation [6])

Position x (m)	$B_{theory150}$	$B_{theory75}$
-0.12		
-0.08		
-0.04		
0.00		
0.04		
0.08		
0.12		

Plot B – x

For solenoid 150 turns (experimental)
solenoid 75 turns (experimental)
solenoid 150 turns (theoretical)
solenoid 75 turns (theoretical)



- **Discuss the graphs (see Figure 3 in guide).**