SAKARYA UNIVERSITY
FACULTY OF ENGINEERING
2022-2023 SPRING TERM
PHYS-II LABORATORY - EXPERIMENT REPORT

Name-Surname: **No :**

EXPERIMENT NUMBER: 1

EXPERIMENT NAME: PARALLEL PLATE CAPACITORS AND DIELECTRIC MATERIALS

OBJECTIVE OF THE EXPERIMENT ***(5 points):***

THEORY OF THE EXPERIMENT ***(15 points):***

1. Write the definitions and units of the following concepts.

Capacitor:

Charge (q):

Voltage (V):

Capacitance (C):

Dielectric material:

Electrical conductivity:

Dielectric constant:

2. The dielectric coefficient of the dielectric material placed between the plates of a capacitor with a cross-sectional area of 0.6 m^2 and a distance between the plates of 0.5 mm is k=8.5. Accordingly, calculate the capacitance of this capacitor in Farads.

THE EXPERIMENTAL SETUP ***(5 points):***

1. Draw the experimental setup you used in the experiment.

2. Briefly explain the names of the materials used in the experiment.

EXPERIMENTAL PROCEDURE ***(5 points):***

Explain the steps of the experiment in a complete and sequential manner.

EXPERIMENTAL MEASUREMENTS AND CALCULATIONS:

1) Measure the radius of the plates and write the area in the corresponding place in Table 1 and Table 2.

r=……. ***(5 points)***

2) Write the measured distances and capacitance values between the plates in the required sections in Table 1. ***(15 points)***

Table 1. Electrical conductivity table of air

d (m)	**C (F)**	**A (m^2)**	**ε_{air} (C^2/Nm^2)**

3) Find the electrical permeability (ε_{air}) of the medium (air) for each case using the equation $C = \varepsilon$.(A/d) and fill in the relevant part in Table1. ***(10 points)***

4) Find the electrical permeability and relative dielectric constant of the air by averaging the value you found. Calculate the percent error by comparing the dielectric constant with the theoretical value. Comment your result. (Theoretical value of the dielectric coefficient of air is κ_{air}=1.006.) ***(10 points)***

5) Put mica between the plates and compact it well. Write the distance between the plates and the capacitance value in the necessary places in Table 2. ***(10 points)***

Table 2.

	d (m)	C (F)	A (m^2)	$\varepsilon_{material}(C^2/Nm^2)$	K	$K_{Therotical}$
Mica						6

6) Find the electrical permeability ($\varepsilon malzeme$) of mica using the equation $C = \varepsilon$(A/d) and fill in the relevant part in Table 2. Calculate the percent error by finding the relative dielectric constant and comparing it with the theoretical value. (κ_{air}=1.006) ***(10 points)***

7) Explain and interpret the results you obtained at the end of the experiment. ***(10 points)***

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Name-Surname: **No :**

EXPERIMENT NUMBER: 2

EXPERIMENT NAME: KIRCHHOFF RULES AND WHEATSTONE BRIDGE

OBJECTIVE OF THE EXPERIMENT (5 points):

THEORY OF THE EXPERIMENT (15 points):

1. Briefly define the terms given below.

a. Resistor:

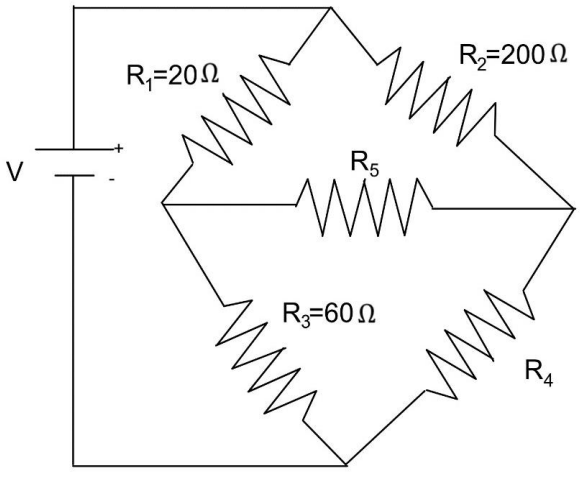
b. Rheostat:

c. Short circuit:

d. Voltmeter:

e. Amperemeter:

2. Since there is no current flowing through the resistor R_5 in the circuit below, what is the value of the resistor R_4 in ohms?



THE EXPERIMENTAL SETUP (5 points):

1. Draw the experimental setup you used in the experiment.

2. Briefly explain the names of the materials used in the experiment.

EXPERIMENTAL PROCEDURE (5 points):

Explain the steps of the experiment in a complete and sequential manner.

EXPERIMENTAL MEASUREMENTS AND CALCULATIONS:

1) Theoretically, obtain the rheostat value R4 that balances the Wheatstone bridge.

(10 points)

2) Write the length of the rheostat L (with its unit) balancing the Wheatstone bridge**.**

(10 points)

L=…….

3) The resistor value of R_4, which stabilizes the Wheatstone bridge;

$$R_4 = \frac{\text{total resistance of rheostat}}{\text{total length of the rheostat}} \times \text{length of equilibrium value } (L)$$

calculate using the equation. ***(15 points)***

4) Calculate the % error by comparing the theoretical and experimental values of R_4. ***(10 points)***

5) Explain what might have caused the difference between the theoretical value and the experimental value. ***(10 points)***

QUESTIONS

1. Why is the ammeter not connected in parallel to the circuit? ***(5 points)***

2. Why is the voltmeter not connected in series with the circuit? ***(5 points)***

3. Explain what is the equilibrium condition of the Wheatstone bridge. ***(5 points)***

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Name-Surname: **No :**

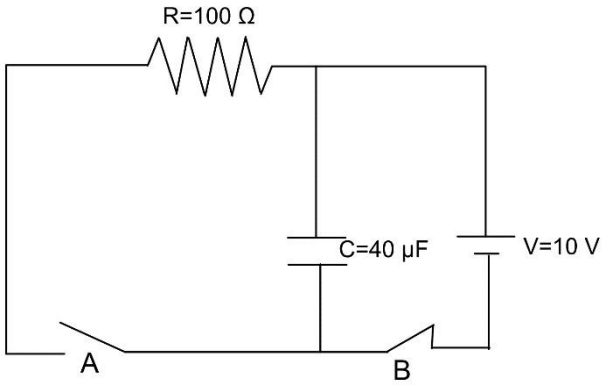
EXPERIMENT NUMBER: 3

EXPERIMENT NAME: DETERMINATION OF RC TIME CONSTANT

OBJECTIVE OF THE EXPERIMENT *(5 points):*

THEORY OF THE EXPERIMENT *(15 points):*

1. In the circuit in the figure, switch B is closed and the capacitor is fully charged, and switch B is opened and switch A is closed. According to this;



a. What is the first current flowing through the circuit after the switch A is closed, in Amperes?

b. After the switch A is closed, how long does it take for the current flowing through the circuit to decrease to 0.01 Amperes?

THE EXPERIMENTAL SETUP ***(5 points):***

1. Draw the experimental setup you used in the experiment.

2. Briefly explain the names of the materials used in the experiment.

EXPERIMENTAL PROCEDURE ***(5 points):***

Explain the steps of the experiment in a complete and sequential manner.

EXPERIMENTAL MEASUREMENTS AND CALCULATIONS:

TABLE 1

V=..... Volt, $C = \cdots..\mu F$, $R = \cdots\ldots..M\Omega$		
I (A)	t (s)	$-\ln(I)$
$10{,}0 \times 10^{-6}$		
$9{,}5 \times 10^{-6}$		
$9{,}0 \times 10^{-6}$		
$8{,}5 \times 10^{-6}$		
$8{,}0 \times 10^{-6}$		
$7{,}5 \times 10^{-6}$		
$7{,}0 \times 10^{-6}$		
$6{,}5 \times 10^{-6}$		
$6{,}0 \times 10^{-6}$		
$5{,}5 \times 10^{-6}$		
$5{,}0 \times 10^{-6}$		
$4{,}5 \times 10^{-6}$		
$4{,}0 \times 10^{-6}$		
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$3{,}0 \times 10^{-6}$		
$2{,}5 \times 10^{-6}$		
$2{,}0 \times 10^{-6}$		
$1{,}5 \times 10^{-6}$		
$1{,}0 \times 10^{-6}$		
$0{,}5 \times 10^{-6}$		

1)Fill in Table 1 using the data you obtained from the experiment. ***(10 points).***

2) Using the data in the table, draw the -ln(I) - t graph on millimeter paper. ***(15 points)***

3) Find the time constant RC from the slope of the graph you have drawn. ***(15 points)***

R.C(experimental) = …….

4) Calculate the theoretical value of the R.C time constant. ***(10 points)***

5) Calculate the error rate in % using the theoretical and experimental RC values. ***(10 points)***

6) Explain and interpret the result you obtained in the experiment. ***(10 points)***

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Name-Surname: **No :**

EXPERIMENT NUMBER: 4

EXPERIMENT NAME: MAGNETIC FIELD IN THE CENTER OF A CURRENT WIRE RING

OBJECTIVE OF THE EXPERIMENT ***(5 points):***

THEORY OF THE EXPERIMENT ***(15 points):***

1. Explain what are electric force and magnetic force. Write the mathematical equations of these two forces and indicate the similarities-differences between them.

2. The current amount passing over a solenoid (coil) with N=10 windings and l=20 cm length is 1.2 A. What is the magnitude of the resultant magnetic field formed in the center of the solenoid?

THE EXPERIMENTAL SETUP ***(5 points):***

1. Draw the experimental setup you used in the experiment.

2. Briefly explain the names of the materials used in the experiment.

EXPERIMENTAL PROCEDURE ***(5 points):***

Explain the steps of the experiment in a complete and sequential manner.

EXPERIMENTAL MEASUREMENTS AND CALCULATIONS:

1. Fill in Table 1 using the data obtained from the experiment. ***(15 points)***

Table-1 Current and number of turns data table

Measurement Number	**Current (A)**	**Number of turn (N)**	**Deviation angle (θ)**	**tanθ**
Part 1				
1				
2				
3				
4				
Part 2				
1				
2				
3				
4				

2. Draw "tanθ-I" and "tanθ-turn number" graphics on millimetric paper***. (25 points)***

3. Briefly explain the relationship between the magnetic field strength in the center of the ring and the current flowing through the ring. ***(15 points)***

4. Briefly explain the relationship between the magnetic field strength in the center of the ring and the number of turns. ***(15 points)***

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Name-Surname: **No :**

EXPERIMENT NUMBER: 5

EXPERIMENT NAME: TRANSFORMERS AND INDUCTION COIL

OBJECTIVE OF THE EXPERIMENT (5 points):

THEORY OF THE EXPERIMENT (15 points):

1. What kind of differences does the coil work with direct current or alternating current? Please state briefly.

2. In a transformer system operating with alternating current, the number of turns of the first coil is N_1 = 50 and the applied voltage is V_1 = 5 V. The number of turns of the second coil is N_2 = 150, and what should the voltage value from this coil be theoretically?

THE EXPERIMENTAL SETUP (5 points):

1. Draw the experimental setup you used in the experiment.

2. Briefly explain the names of the materials used in the experiment.

EXPERIMENTAL PROCEDURE (5 points):

Explain the steps of the experiment in a complete and sequential manner.

EXPERIMENTAL MEASUREMENTS AND CALCULATIONS:

1. Fill in Table 1 using the data from the first part of the experiment ***(10 points).***

Table 1. Ratio of voltage to number of turns data table

Number of Turns of the First Coil	Number of Turns of the Second Coil	input voltage (V)	output voltage (V) (cover closed)	output voltage (V) (cover open)
N_1=…….	N_2=…….	2		
		3		
		4		
		5		
		6		
	N_2=…….	2		
		3		
		4		
		5		
		6		

2. Draw V_1-V_2 graphs on millimetric paper for each N_2 value above for the closed cover. (Note: Plot the graph with V_1 values on the x-axis and V_2 values on the y-axis). ***(10 points)***

3. Determine the experimental N_2/N_1 values by finding the slope (V_2/V_1) of each graph. ***(8 points)***

For the 1st chart:

Slope= V_2/V_1=…….. N_2/N_1=……

For the 2nd chart:

Slope= V_2/V_1=…….. N_2/N_1=……

4. Calculate the % error by comparing each experimental N_2/N_1 ratio with the theoretical N_2/N_1 ratios. ***(5 points)***

5. For the second part of the experiment, connect a transformer with an unknown number of turns to the output and fill in Table 2 with the data you obtained. ***(5 points)***

Table 2. Coil data table with unknown number of turns

Number of Turns of the First Coil	Coil with unknown number of turns	input voltage (V)	output voltage (V)
N_1=…….	N_2=?	2	
		3	
		4	
		5	
		6	
		7	
		8	

6. Using this table, draw the V_2/V_1 voltage graph for the coil whose number of turns is unknown.

(6 points)

7. Find the number of turns of the coil using the slope of the graph. ***(5 points)***

8. Explain and interpret the results you found in the 1st and 2nd parts of the experiment. ***(6 points)***

QUESTIONS

1. What is Induction and How does an Induction current occur? ***(5 points)***

2. What is the reason for the difference between the potential values we read when we close the lid of the U-shaped iron in the first part of the experiment and the potential values we read when the lid is open? ***(5 points)***

3. In which areas and for what purposes are transformers used? ***(5 points)***