جامعة محمد بوضياف- المسيلة -
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كلية التكنولوجيا
Faculty of Technology
قسم الهندسة الكهربائية و قسم الإلكترونيك
Department of Electrical Engineering and Department of Electronics

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University year: 2024/2025 السنة الجامعية :2024 /2025
2nd year Electrical Engineering and Electronics السنة الثانية هندسة كهربائية و إلكترونيك
Applied Work in Electrical Measurement أعمال تطبيقية في القياسات الكهربائية

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PW n° 01: MEASUREMENT OF RESISTANCES

Duration: 1^h30.

Date of the experiment: ……. /……../…….. .

Report prepared by:

Last Name	**First Name**	**Group**	**S/Group**	**Final Note**
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-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Instructions :

- **Internal laboratory regulations must be observed.**
- **You must wear a lab coat.**
- **Attendance is compulsory and will be monitored. Any unjustified absence or failure to hand in a report will result in a mark of 0/20.**
- **Have your assemblies checked before connecting the voltage source.**
- **It is strictly forbidden to move equipment from one station to another. In the event of a breakdown or faulty equipment, contact the teacher.**
- **The report must be written by a maximum of four students.**
- **The report must be handed in at the beginning of the next session.**
- **The report must include the following sections:**
  - **TP cover page.**
  - **The date of the practical session.**
  - **Last Name and first name of the main writer.**
  - **Last Names and first names of the WP participants.**
  - **Preparation and work in manuscript.**

Person in charge of practical work: Dr. Abderrzak Laib

PW n°01: MEASUREMENT OF RESISTANCES

Objectives:

- Measure the values of unknown resistances using the following methods:

✓ Ohmmeter

✓ Volt-Ampere (Volt-Ampere Metric) method

- Evaluate the relative accuracy of each method.

Equipment:

- Resistors
- Stabilized power supply
- Voltmeter, ammeter, and multimeter

I. Method 1: Direct Measurements Using the Ohmmeter

Determine the values of resistances R1 and R2 using the multimeter in ohmmeter mode. Then calculate the absolute and relative uncertainties by applying the following formula:

$$\Delta R = R * \text{Precision} + \text{Number of digits} * \text{Resolution}$$

Where:

- **R**: is the measured resistance.
- **Precision:** refers to the manufacturer's specified precision of the measuring device.
- **Number of digits:** is the number of significant digits displayed by the multimeter.
- **Resolution** :is the smallest change in resistance that the multimeter can detect.

The ohmmeter manual for determining the precision of measurements provided according to the applied range is given by the following uncertainty table:

Range	Precision + Number of Digits	Resolution	Uncertainty
200Ω	±(1%+3 digits)	0,1Ω	4,5Ω
2kΩ	±(0,8%+1 digits)	1Ω	30Ω
20kΩ	±(0 ,8%+1 digits)	10Ω	300Ω
200kΩ	±(0,8%+1digits)	100Ω	3kΩ
2MΩ	±(0.8%+1 digits)	1kΩ	42kΩ

Measure the resistances, then calculate the uncertainty for each measurement, and complete the following table:

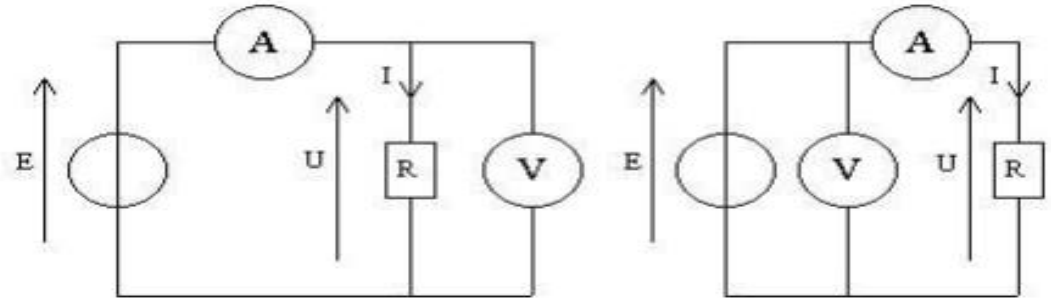
Person in charge of practical work: Dr. Abderrzak Laib

	Measurement of R1	Measurement of R2
Range		
R		
ΔR		
$\partial R = \Delta R/R$		

II. Method 2: Measurements Using the Volt-Ampere Method

II.1 Selection of the Appropriate Circuit Configuration

The task is to select the appropriate circuit configuration, either downstream or upstream, for measuring each of the resistances R1 and R2 given the imposed measuring instruments. After performing the measurements, determine the value of each resistance and its associated uncertainty for the chosen configuration.



Downstream Circuit (Short Branch) Upstream Circuit (Long Branch)

The choice of the circuit configuration will be made according to the following rule:

- If $R_{Approximated\ Resistance} \leq \sqrt{R_A * R_v}$ (Low-value resistances) The downstream circuit configuration is preferred.
- If $R_{Approximated\ Resistance} \geq \sqrt{R_A * R_v}$ (High-value resistances) The upstream circuit configuration is preferred.

II.2 Measurement Table

- E = 5V
- Ammeter Class = …….
- Voltmeter Class = …….

PW n°01: MEASUREMENT OF RESISTANCES

	Measurement of R1	**Measurement of R2**
Adopted Circuit Configuration	**Downstream**	**Downstream**
Range for I (R_A)		
Scale for I (S_A)		
Reading for I (Re_A)		
$Im=(Re_A/S_A)*R_A$		
Range for V (R_V)		
Scale for V (S_V)		
Reading for V (Re_V)		
$Im=(Re_V/S_V)*R_V$		
Rm=Um/Im		
ΔRm		

	Measurement of R1	Measurement of R2
Adopted Circuit Configuration	Upstream	Upstream
Range for I (R_A)		
Scale for I (S_A)		
Reading for I (R_A)		
$I_m=(R_A/S_A)*R_A$		
Range for V (R_V)		
Scale for V (S_V)		
Reading for V (R_V)		
$I_m=(R_V/S_V)*R_V$		
Rm=Um/Im		
ΔRm		

4. Remarks:

➢ **Absolute uncertainty** ΔX: The calculation of the absolute uncertainty ΔX due to a measurement device with deviation is given by:

$$\Delta X = \frac{Class * Range}{100}$$

➢ **Relative uncertainty**: Usually expressed as a percentage (%).

$$\frac{\Delta R}{R} = \frac{\Delta I}{I} + \frac{\Delta V}{V}$$

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Conclusion----------