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 Fundamentals of Electrotechnics 1 — أعمال تطبيقية في الكهروتقني الأساسية 1

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PW n°01 : Measuring Voltage, Current and Power in Single Phase

Duration : 1^h30.

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

Report prepared by:

Last Name	**First Name**	**Group**	**S/Group**	**Final Note**
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-	-	-	-	-
-	-	-	-	-
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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 ROUABHI.R

PW n°01 **: Measuring Voltage, Current and Power in Single Phase**

I- Aim of the manipulation:

The aim of this experiment is to learn how to measure voltage, current, active and reactive power and power factor in a single-phase circuit.

II- Equipment used:

- Power sources (AC).
- Electrical loads (resistors, inductors and capacitors).
- Instruments (multimeters, power meters).

III- Evaluation method:

Continuous assessment: 100%.

IV- Theoretical reminder:

Note :

i, u: instantaneous values of current and voltage respectively.

I, U: effective values of current and voltage respectively.

1) The electrical voltage:

It is a difference in potential (d.p) between two points, reflecting an electrical imbalance or different electrical charges, and is measured by a voltmeter.

The voltmeter is a device that is connected in parallel with the component or dipole whose terminal voltage is to be measured. There are three types of voltmeters:

1) The analogue voltmeter.
2) The digital voltmeter.
3) The multimeter.

Figure (1) shows the position of the voltmeter in a single phase circuit.

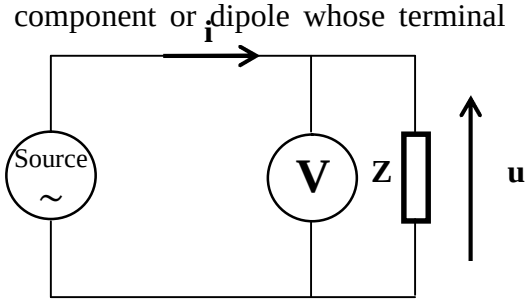

Figure 1

2) The electric current:

Electric current results from the movement of electric charges between two points on a branch. Its intensity reflects the flow of moving charges and is measured by an ammeter.

An ammeter is a device connected in series with the component(s) through which the current to be measured flows. There are three types of ammeter:

1) The analogue ammeter.
2) The digital ammeter.
3) The multimeter.

Figure (2) shows the position of the ammeter in a single-phase circuit.

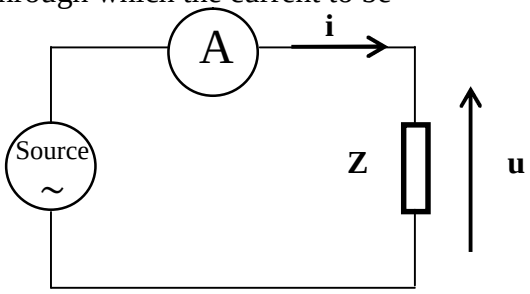

Figure 2

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3) The electrical power :

Figure (3) shows the position of the power meter in a single-phase circuit.

Any electrical system that uses alternating current contains two forms of power: active and reactive.

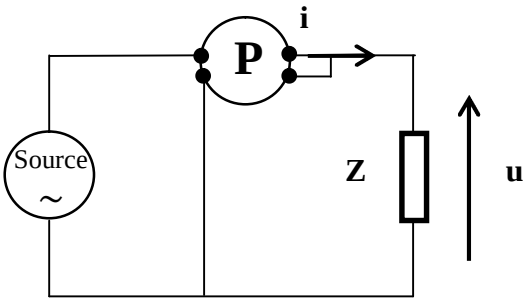

Figure 3

- **The active power P**

It is completely converted into useful energy in the form of mechanical, thermal or light energy. The average active power is defined by the following relationship: $\boxed{P = UI\cos(\varphi)}$ (W)
Where φ is the phase difference between current I and voltage U.

- **The reactive power Q**

It is used to magnetise the magnetic circuits of electrical machines (transformers and motors). The average reactive power is defined by: $\boxed{Q = U\ I\ \sin(\varphi)}$ (VAR)

- **The apparent power S**

It is equal to the vectorial sum of the two active and reactive powers. Apparent power is given by :: $\boxed{S = U\ I}$(VA)

From the above expressions we can write:$S = \sqrt{P^2 + Q^2}$, and $\cos(\varphi) = \frac{P}{S}$ (power factor)
and $Q = P.\,tg(\varphi)$

4) Single-phase power measurement

Active power, reactive power and apparent power are measured directly by a power meter. The single-phase power meter is a device for measuring single-phase power. It consists of two coils: a current coil, which measures the current flowing through the load (equivalent to an ammeter), and a voltage coil, which measures the voltage across the load (equivalent to a voltmeter). (fig.3)

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V- Experiment

1) Single phase voltage, current and power measurement:

Carry out the assembly shown in Figure 4:

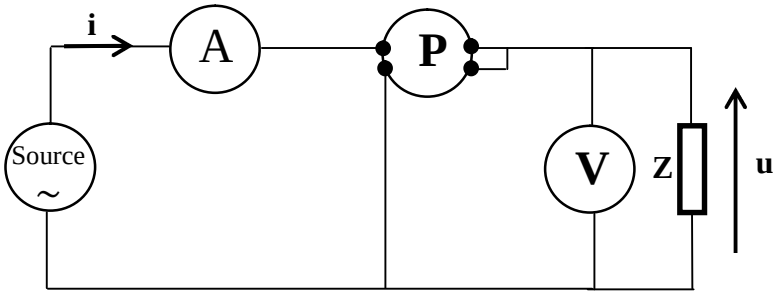

Figure 4

PW n°01 : Measuring Voltage, Current and Power in Single Phase

Load Z consists of the series connection of passive elements whose corresponding values are as follows:

- Resistance R=100 Ω; maximum current 1A.
- Iron core coil with inductance L = 60m H and internal resistance r = 1.2 Ω; maximum current 2.5A.
- Capacitor C= 16µF.

For each receiver

1. Calculate the value of Z.
2. Complete the following tables (assembly fig.4).

1. Load R

U=50V.
R= 100 Ω.

$Z =$ ……

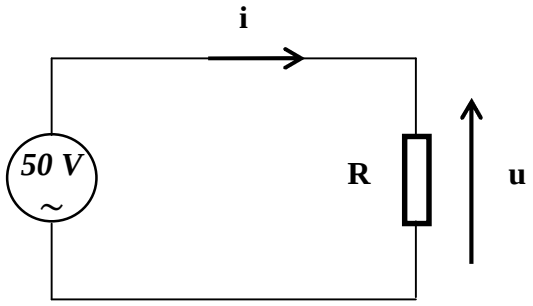

Figure 5

Greatness	U(V)	I(A)	P(Watt)	Q(Var)	S(VA)	Cos(φ)
Formula						
Calculation						
Measurement						

Table 1

What can we conclude?

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2. Load L

U=50V.
L= 60mH.
r =1.2Ω.
f=50Hz.

$Z =$ ……

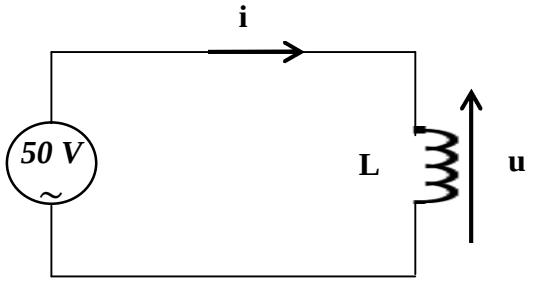

Figure 6

Greatness	U(V)	I(A)	P(Watt)	Q(Var)	S(VA)	Cos(φ)
Formula						
Calculation						
Measurement						

Table 2

Person in charge of practical work: Dr ROUABHI.R

What can we conclude?

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3. Load C

U=50V.
C= 16µF.
f=50Hz.

$Z =$ ……

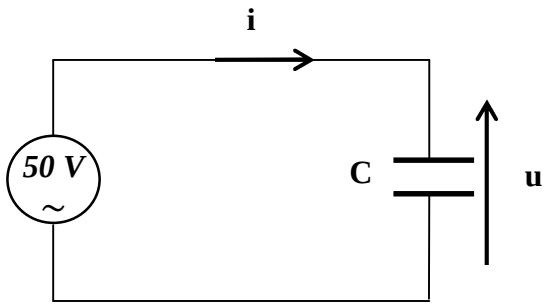

Figure 7

Greatness	U(V)	I(A)	P(Watt)	Q(Var)	S(VA)	Cos(φ)
Formula						
Calculation						
Measurement						

Table 3

What can we conclude?

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4. Load RL

U=50V. R=100Ω.
L= 60mH.
r =1.2Ω.
f=50Hz.

$Z =$ ……

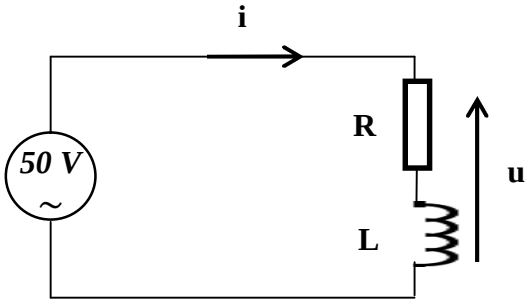

Figure 8

Greatness	U(V)	I(A)	P(Watt)	Q(Var)	S(VA)	Cos(φ)
Formula						
Calculation						
Measurement						

Table 4

What can we conclude?

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5. Load RLC

U=50V.
R=100Ω.
L= 60mH.
r =1.2Ω.
C= 16 µF.
f=50Hz.

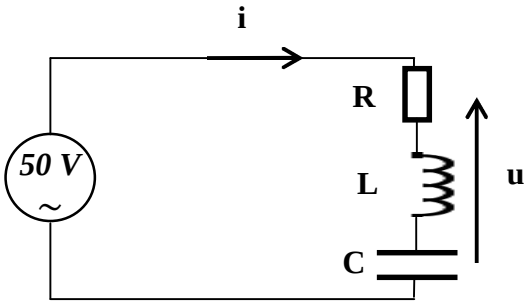

Figure 9

$Z =$ ……

Greatness	U(V)	I(A)	P(Watt)	Q(Var)	S(VA)	Cos(φ)
Formula						
Calculation						
Measurement						

Table 5

What can we conclude?

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VI- Conclusion.

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