جامعة محمد بوضياف- المسيلة -
Mohamed Boudiaf University at M'sila
كلية التكنولوجيا
Faculty of Technology
قسم الهندسة الكهربائية
Department of Electrical Engineering

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*University year: 2025/*2026 — السنة الجامعية : 2026/2025
2nd year Electrical Engineering — السنة الثانية هندسة كهربائية
Applied Work in Electrical and Electronic Measurements — أعمال تطبيقية في القياسات الكهربائية والإلكترونية

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PW n°04: Phase shift measurement

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: Pr ROUABHI.R

***PW n°04*: Phase shift measurement**

I. Aim of the manipulation

- ✓ Learn to use an oscilloscope: setting, starting, displaying and measuring alternating signals (amplitude, frequency and phase shift).
- ✓ Learn to use a basic frequency generator (GBF).

II. Equipment used

- ➢ Basic frequency generator (GBF).
- ➢ Oscilloscope.
- ➢ Measuring instruments (multimeters, Phasemeter).
- ➢ Electrical loads (resistors and capacitors).

III. Evaluation method

Continuous assessment: 100%.

IV. Theoretical reminder:

The oscilloscope is a measuring instrument that can be used to display and analyse electrical signals as a function of time, or variations in one voltage as a function of another. The oscilloscope accepts two input channels, allowing you to view two separate electrical signals on the same screen (so you can compare frequencies, amplitudes and phase shifts).

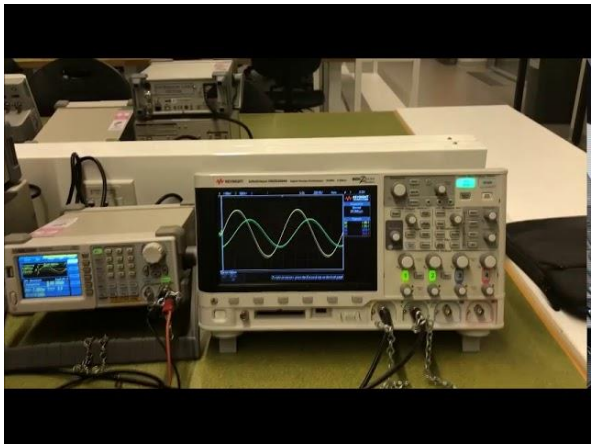

Figure 1: Picture of the oscilloscope connected to GBF

1) How to use an oscilloscope (Basic Approach)

- Connection: Connect the probe to a channel and earth to the circuit.
- Time base setting: Adjust to see a few periods of the signal.
- Volt/Div setting: Adjust so that the signal occupies part of the screen.
- Trigger: Set to a rising or falling edge to stabilise the display.
- Measurement: Use the cursors or automatic functions.

Person in charge of practical work: Pr ROUABHI.R

2) Voltage measurement

To measure a voltage (V) with an oscilloscope, you must choose a calibre such that - the amplitude of the peak-to-peak signal occupies most of the height of the screen; this allows the signal to be displayed without overshoot, thus minimising reading errors.

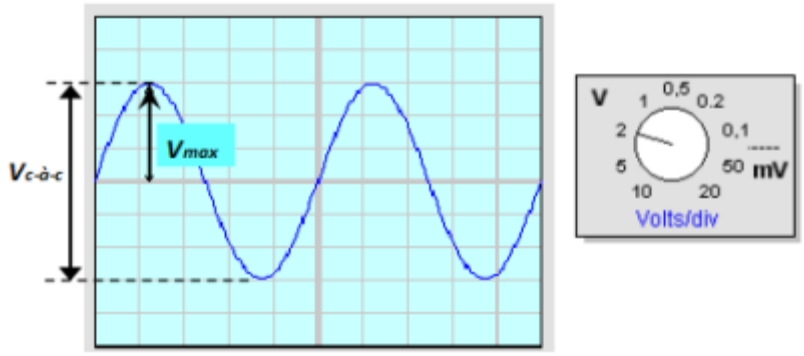

Figure 2: Measure a voltage (V) with an oscilloscope

We have: $\mathbf{V_{p\text{-}t\text{-}p}}$ **= Number of cm. Range**

$\mathbf{V_{max} = V_{p\text{-}t\text{-}p} /2}$

$\mathbf{V_{rms} = V_{max} /2}$

The effective value $\mathbf{V_{rms}}$ is the value indicated by the multimeter when used to measure an alternating voltage.

3) Frequency measurement

To measure the frequency of a signal on an oscilloscope, you must select a time base position where the signal period occupies most of its length. This minimises reading errors.

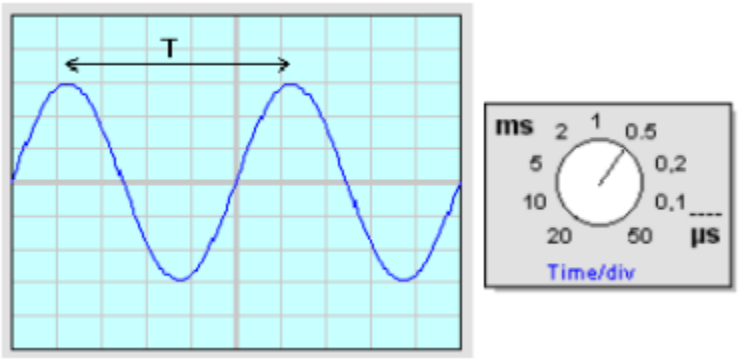

Figure 3: Measure a frequency (Hz) with an oscilloscope

We have: **T = Number of cm. Range**

f = 1 / T

4) Phase shift measurement

To measure the offset between two signals, they need to be observed simultaneously. To do this, you need to take the two voltages relative to a common point, which is earth. We then use the direct method, which is applicable when the two signals have the same frequency. Consider two periodic signals, one of which is out of phase with the other (lagging or leading), as shown in Figure 4:

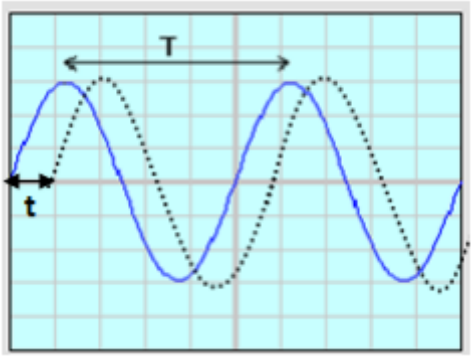

Figure 4: Measure a Phase shift with an oscilloscope

To calculate the phase shift φ (in degrees) we have: $\varphi = t / T \times 360°$

With: **T**: Period of the signal.

t: Offset between the two signals.

V. Practical part

1) Voltage measurement

Using a function generator (GBF), apply a sinusoidal voltage to the input of channel I of the oscilloscope and select the correct rating to display the signal correctly.

- Measure the RMS voltage from the amplitude displayed on the oscilloscope screen.
- Use a multimeter to measure the voltage.
- Record these values in Table 1 and do the same for a triangle and square wave signal.

			
Range . Oscillo (V/cm)			
Nber of cm (p-t-p)			
$V_{p\text{-}t\text{-}p}$(v)			
V_{max}			
V_{rms}			
V_{mult}			

Table 1

Interpretation of results

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2) Frequency measurement

Using a GBF, apply a sinusoidal signal with a frequency of more than 100 Hz to the input of channel I, then select the calibers that allow the signal to be displayed correctly.

- Measure the period of this signal and enter these values in Table 2.
- Do the same for a triangular signal and a square wave signal.

			
Freq. GBF(Hz)			
Range . B.Temps (ms/cm)			
Nber of cm (for T)			
T(s)			
f= 1/T (Hz)			

Table 2

Interpretation of results

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3) Phase shift measurement

- Carry out the following assembly:

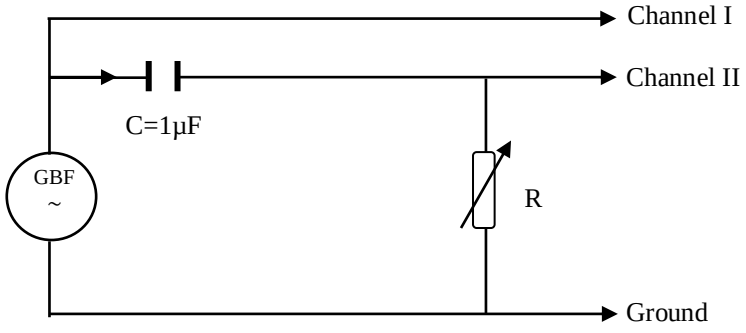

Figure 4: Phase shift measurement method

- Check that the GD buttons are pressed (input signal is grounded), then align the two oscilloscope traces so that they are perfectly superimposed on the x-axis.
- Vary the resistance R and determine the phase shift for each value of R.
- Record these values in Table 3.

R (KΩ)	**1**	**2**	**4**	**8**	**10**
t (ms)					
T (ms)					
φ= t /T ×360°					
φ with Phasemeter					

Table 3

Interpretation of results

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VI. Conclusion

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