University Mohamed Boudiaf of M'Sila
Faculty of Technology
Electrical Engineering Department
Option: ELT, ELM, ERE

Module: Basic Electrical Engineering 1
Level of study: 2nd year
Academic year: 2024-2025
Semester: 03

# Series N°1: Mathematical reminder on complex numbers CN

## Exercise 01:

Let the complex numbers shown below:

$\underline{a}$ = (60 + $j$ 80) + (30 -$j$ 40); $\underline{b}$ = (12 -$j$ 6) -(40 -$j$ 20); $\underline{c}$ = (6 + $j$ 8) (3 -$j$ 4); $\underline{d}$ = (16 + $j$8) ÷ (3 -$j$ 4)

Write these numbers in:

Algebraic or rectangular form; polar form; and exponential form.

## Exercise 02

Let the two complex numbers $\underline{Z}_1 = 20 + j15$ *and* $\underline{Z}_2 = 10 - j8$ .

A. Calculate the modulus and phase of $\underline{Z}_1$, $\underline{Z}_2$ and their exponential forms.

B. For each case, calculate the modulus and argument of the following complex numbers:

1. $\underline{Z}_1 + \underline{Z}_2$ (In electrical engineering, this calculation corresponds to calculating the equivalent impedance of two impedances connected in series). ( $\underline{Z}_{eq} = \underline{Z}_1 + \underline{Z}_2$). **Fig.1**

2. $\underline{Z}_1 . \underline{Z}_2$ (This corresponds, for example, to calculating a voltage v across an impedance $Z$ carried by a current $i$) ($\underline{v} = \underline{Z}\,\underline{i}$ ). **Fig. 2**

3. $\underline{Z}_1 / \underline{Z}_2$ (This corresponds to calculating the current i which crosses an impedance $Z$ whose voltage v, and the current $i$). ($\underline{i} = \underline{v}/\underline{z}$). **Fig. 2**

4. $\frac{1}{\underline{z}_1} + \frac{1}{\underline{z}_2}$ (This calculation corresponds to determining the equivalent impedance of two impedances connected in parallel).( $\frac{1}{\underline{Z}_{eq}} = \frac{1}{\underline{z}_1} + \frac{1}{\underline{z}_2}$ ). **Fig. 3**

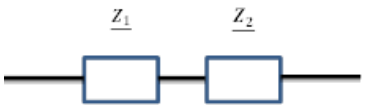


Fig. 1

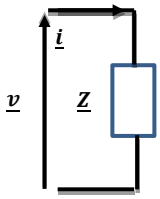


Fig. 2

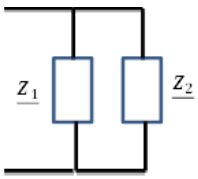


Fig. 3

## Exercise 03:

Calculate the modulus, argument and conjugate of the following complex numbers:

$$\underline{Z}_1 = 2 + j3\ ;\ \underline{Z}_2 = 2 - j3\ ;\ \underline{Z}_3 = -2 + j3\ ;\ \underline{Z}_4 = -2 - j3$$

2. Give their polar and exponential forms.

3. Calculate the following operations : $\underline{Z}_1 + \underline{Z}_2$ ; $\underline{Z}_3 - \underline{Z}_4$ ; $\underline{Z}_4 . \underline{Z}_2$ ; $\underline{Z}_3 / \underline{Z}_4$ .