PEOPLE`S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
Mohamed Boudiaf University - M'sila

Faculty of Technology
Department of Electrical Engineering
Fundamental Electronics 1

2nd Year Academic License
Year academic: **2025/2026**

First Series of Exercises :

Continuous regime and fundamental theorems

Exercise 1: (Kirchhoff's laws)

Consider the circuit in Figure 1:

1- Determine the number of **nodes**, the number of **branches**, as well as the number of possible **meshes**.
2- By applying **Kirchhoff's laws**, write the equations of the meshes.
3- Determine the current intensities in the three branches. Knowing that : $R_1 = 2\Omega$, $R_2 = 5\Omega$, $R_3 = 10\Omega$, $E_1 = 20V$, $E_2 = 70V$

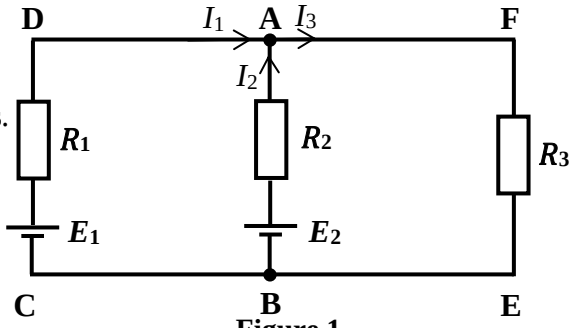


Figure 1

Exercise 2 : (Current divider)

From the circuit in figure 2, determine:

1- The equivalent resistance seen from points ***a*** and ***b***.
2- The current supplied by source V_f.
3- The current flowing through each of the resistors R_1 and R_2.

V_f =18V, $R_1 = 7\Omega$, $R_2 = 2\Omega$.

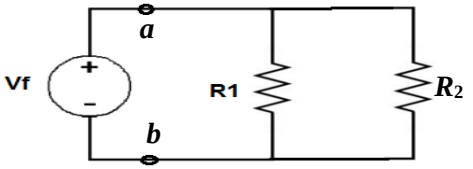


Figure 2

Exercise 3 : (Voltage divider)

By applying the voltage divider, determine the current ***i*** and the voltage ***u***.

$E = 6V$, $R_1 = 100\Omega$, $R_2 = R_3 = R_4 = 50\Omega$.

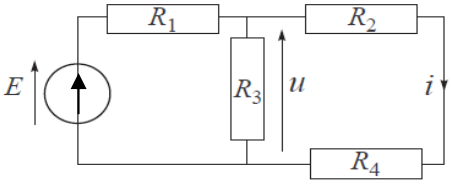


Figure 3

Exercise 4 : (Current/Voltage dividers)

1- Use the **voltage divider theorem** to calculate the voltages V_1 and V_2 in the case of Figure 4.
2- Use the **current divider theorem** to calculate the currents I_1, I_2, I_3, and I_4 in Figure 5.

Data : $E = 3V$, $I = 5A$, $R_1 = R_3 = 1\Omega$, $R_2 = R_4 = 2\Omega$.

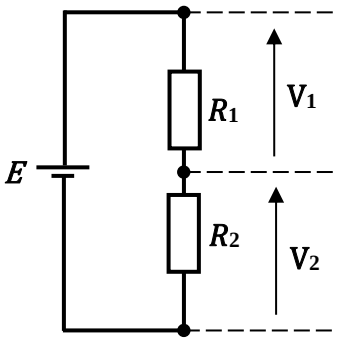


Figure 4

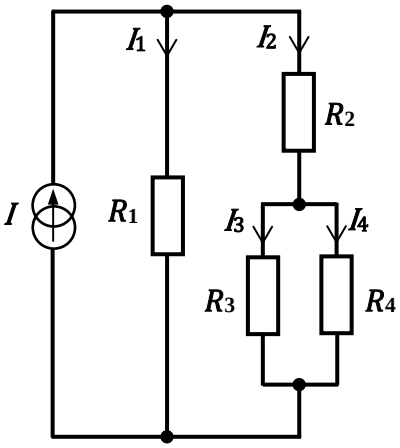


Figure 5

Exercise 5 : (Superposition Theorem)

Using the **superposition theorem**, determine the voltage across resistor R_1.

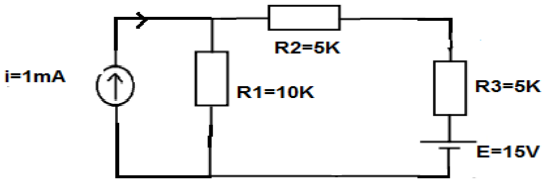


Figure 6

Exercise 6 : (Superposition Theorem)

In figure 7, calculate the voltage V_x by using the **superposition principle**.

Data : E_1 = 6V, E_2 = 12V, I = 2A,
R_1= 1Ω, R_2 =3Ω, R_3 = 6Ω.

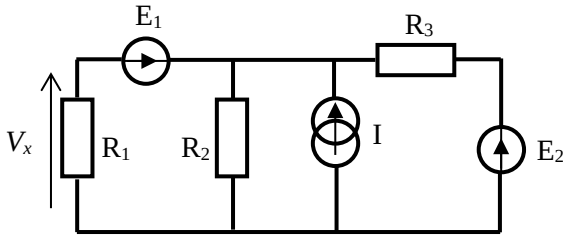


Figure 7

Exercise 7 : (Millman's Theorem)

Applying **Millman's theorem**

1. Calculate the potential difference U between points A and B.
2. Calculate and indicate the direction of the current in each resistance.
3. Check the law of nodes (Kirchhoff's current law).

With : E_1 = 3V, E_2 = 12V, R_1 = R_4 = 1kΩ , R_2 = R_3 = 2kΩ

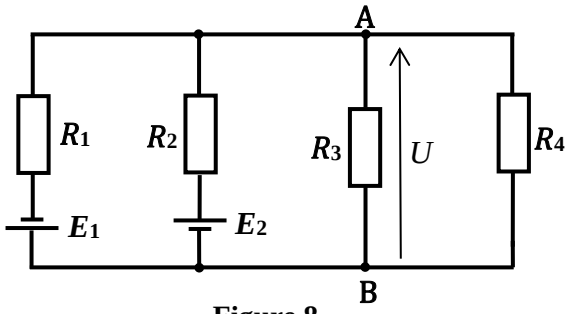


Figure 8

Exercise 8: (Kennelly transformations)

Consider the circuit shown in figure 9.

- Calculate the values of currents I and I_l.

E = 10V, R_1 = R_2 = R_3 =100Ω, R_4 = R_5 =50Ω, R_6 =200Ω,

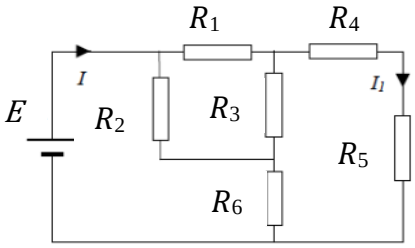


Figure 9

Exercise 9: (Kennelly transformations)

Obtain the equivalent resistance R_{ab} for the circuit in figure 10 and use it to find current i.

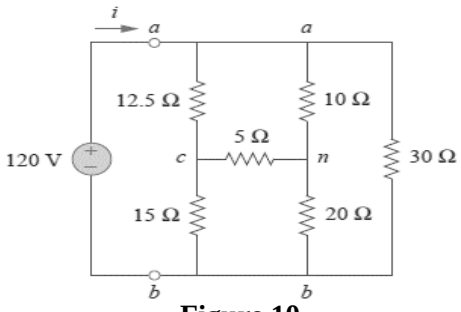


Figure 10

Exercise 10: (Thevenin's Theorem)

- Find the **Thevenin** equivalent of the circuit in figure 11, without taking into account the resistance R.
- Determine the current I flowing in the resistance R

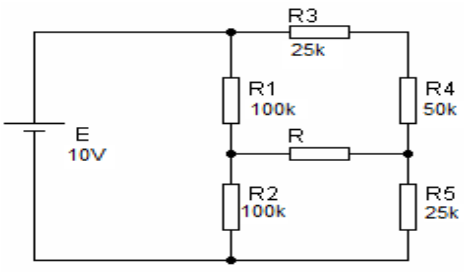


Figure 11

Exercise 11: (Thevenin's Theorem)

Using the **Thevenin's theorem**,

- Determine the voltage across resistor *R*.
- Determine the current *I* flowing in the resistance *R*

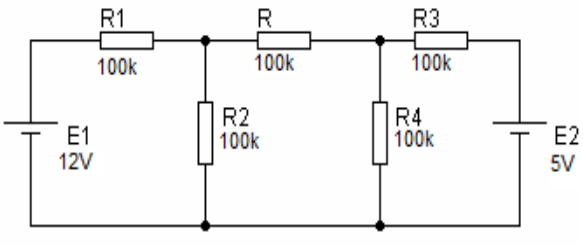


Figure 12

Exercise 12: (Equivalence Thevenin-Norton)

1- Reduce the circuit in the figure opposite to an equivalent Dipole comprising a voltage source V_{eq} in series with a resistor R_{eq}.

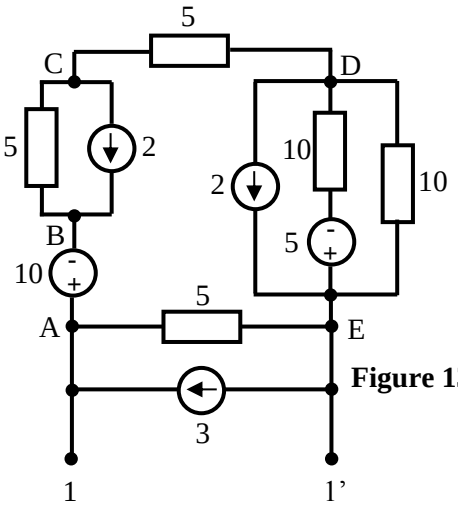


Figure 13

Exercise 13: (Kirchhoff / Superposition/ Millman/thévenin)

Calculate the current intensity in branch AB by applying:

1. The Kirchhoff's laws.
2. The superposition theorem.
3. The Millman's theorem.
4. the Thevenin's theorem.

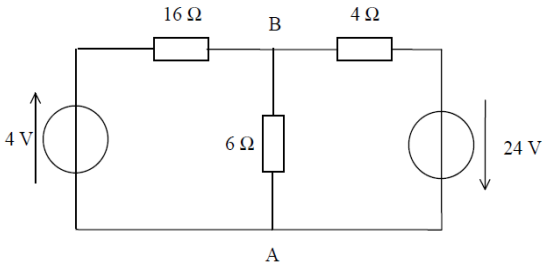
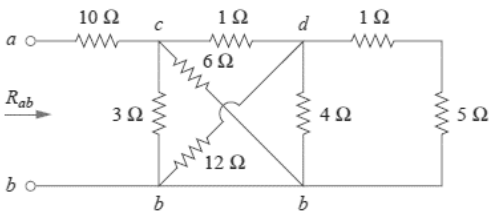


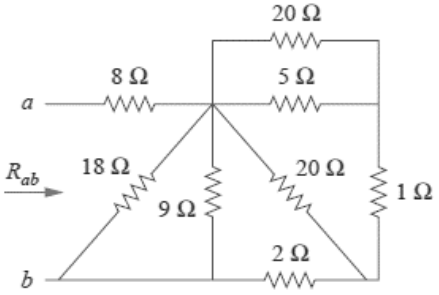
Figure 14

Additional exercises

Exercise 1:

Calculate the equivalent resistance $\boldsymbol{R_{ab}}$ in the following circuits:





Exercise 2:

In the opposite circuit:

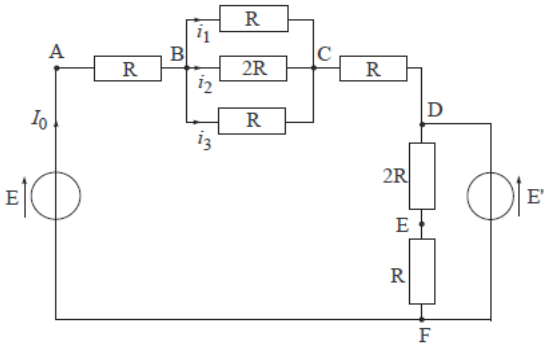
1- Calculate UEF,

2- Calculate the current intensity I_0.

3- Calculate the intensity I' flowing in the branch containing the generator E' (specify its directions).

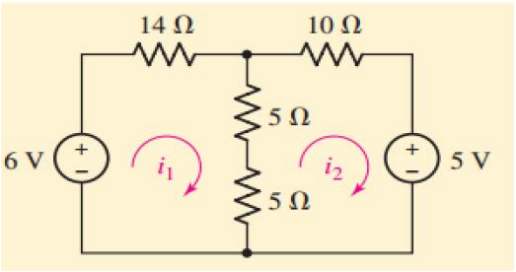
4- Calculate the intensities i_1, i_2 and i_3.

Data : R= 1Ω, E= 5V and E'= 3V.



Exercise 3:

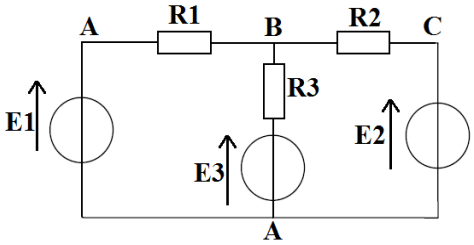
Determine the currents of the meshes i_1 and i_2 in the following circuit:



Exercise 4:

The circuit includes three generators (E_1 = 20V, R_1 = 3Ω, E_2 = 15V, R_2= 4Ω, E_3= 8V R_3=5Ω).

- Determine the value of the current intensity in R_3 by applying the **superposition theorem**.



Exercise 5:

Consider the electrical circuit in Figure 1,
We give the following element values:: R_1= 2KΩ, R_2=4KΩ, R=2KΩ, E_1=20V et E_2 = 10V.

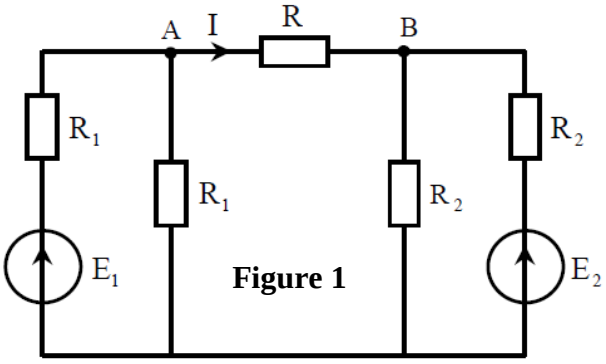


Figure 1

1- Calculate the elements of the **Thévenin** generator (V_{Th} and R_{Th}) seen between terminals A and B (without taking into account the resistance R).

2- Determine the **Norton** generator (I_N and E_N) seen between terminals A and B.

3- Determine the current I in branch AB.

Exercise 6 :

Determine the **Thévenin** generator of the figure 2, without taking into account the resistance R.

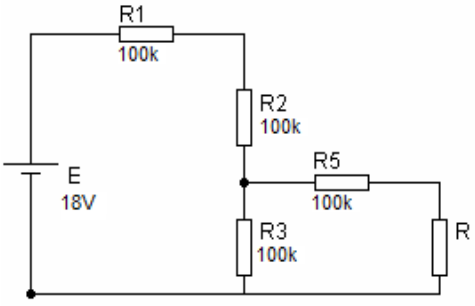


Figure 2