Name : ..... First name : ..... Group : .....

Final Exam of Electronics

Calculators and documents are not allowed. The number of points per question is indicative

Answers to be written on thi document only.

Exercise 1 : MCQ (7 points – without negative points – some questions have more than one answer !)

Surround the correct answer (s).

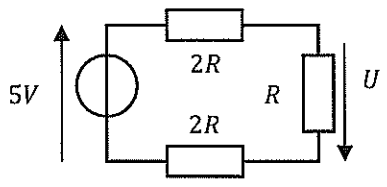
1. What is an ordrered displacement of electric charges ?
   - a- A resistor
   - b- A voltage
   - c- A current
   - d- None of this

2. The going out current is lower than the going in current through the resistor.
   - a- True
   - b- False

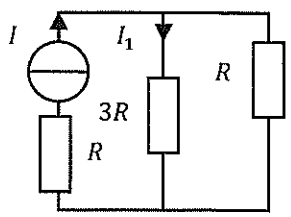
3. A short-circuited resistor has :
   - a- An infinite current flowing through it
   - b- An infinite voltage across its terminals
   - c- A zero current flowing through it
   - d- None of this

4. I_1 and I_2 are two current sources. They can be replaced by one current source I if I_1 and I_2 are:
   - a- In series
   - b- In parallel
   - c- None of this

5. What is the value of the voltage U ?
   - a- $1\,V$
   - b- $-1\,V$
   - c- $2V$
   - d- $-2\,V$



6. Choose the correct formula :



a- $I_1 = \frac{3}{5}.I$

b- $I_1 = \frac{I}{4}$

c- $I_1 = \frac{3}{4}.I$

d- $I_1 = \frac{3R}{4}I$

7. To turn-off a current source, we replace it by :

a- A wire

b- An open-switch

c- A resistor

d- A voltage source

8. To turn-off a voltage source, we replace it by :

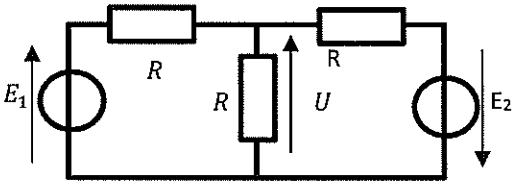
a- A closed switch

b- A resistor

c- An open switch

d- A current source

9. What is the expression of the voltage U ?



a- $U = \frac{E_1+E_2}{3}$

b- $U = \frac{E_1-E_2}{3}$

c- $U = \frac{E_1}{3} + \frac{E_2}{2}$

d- $U = \frac{E_1+E_2}{3R}$

10. The Thevenin's theorem replaces a complex circuit by :

a- A voltage source in parallel with a resistor

b- A current source in parallel with a resistor

c- A voltage source in series with a resistor

d- A current source in series with a resistor

11. The Norton's theorem replaces a complex circuit by :

a- A voltage source in parallel with a resistor

b- A current source in parallel with a resistor

c- A voltage source in series with a resistor

d- A current source in series with a resistor

12. In the Thevenin's theorem, the voltage E_{th} is also called :

a- The voltage of the open-circuit

b- The voltage of the short-circuit

c- None of this

13. In the Norton's theorem, the current I_N is also called :

    a- The current of the open-circuit

    b- The current of the short-circuit

    c- None of this

14. The Millman's theorem is base on :

    a- The Thevenin's theorem

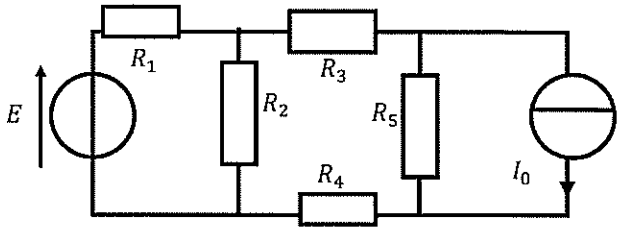
    b- The loops law

    c- The nodes law

    d- The superposition's theorem

Exercise 2 : The Norton's theorem (6 points)

We consider the following circuit :



- $E = 10V, I_0 = 10mA$
- $R_1 = 1k\Omega,\ R_2 = 1{,}2k\Omega,\ R_3 = 500\Omega,\ R_4 = 1{,}5\ k\Omega, R_5 = 2k\Omega$

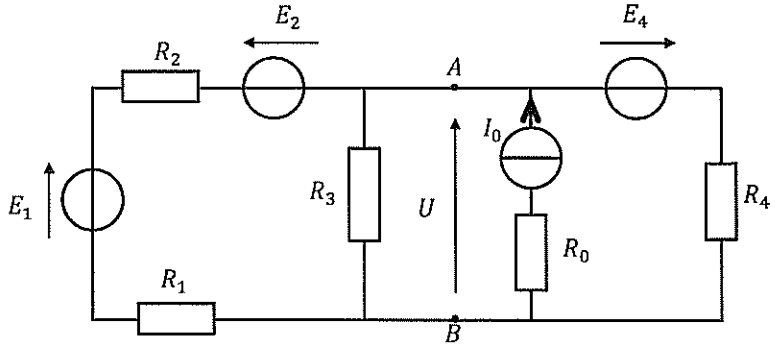
1. Determine the Norton's genarator (I_N, R_N) seen by R_2. You can choose the method that you want (Thevenin-Norton equivalence or the Norton's theorem) and express the result function of I_0, E and all the resistors R_i.

2. Deduce then the current flowing through R_2.

Exercise 3 : General theorems and basic methods (7 points)

We consider the following circuit :

$$E_1 = 20\ V \quad E_2 = 5\ V$$
$$E_4 = 10\ V$$
$$I_0 = 0{,}25\ mA \quad R_0 = 1k\Omega$$
$$R_1 = 10\ k\Omega \quad R_2 = 50\ k\Omega$$
$$R_3 = 12\ k\Omega$$



1. Express the voltage U using the method that you think is the most appropriate (the Kirchoff laws, the superposition's theorem, the Thevenin's theorem, the Norton's theorem or the

Millman's theorem). You have to precise the choosen method before starting the resolution. Express the voltage U function of E_1, E_2, E_4, I_0 and all the resistors R_i.

2. Determine R_4 when the voltage U is equal to 0.

BONUS

We consider the following circuit.

Determine the voltage U using the Millman's theorem.