# Electronic Control

*Calculators and documents are not allowed. The scale is indicative.*
***Answers exclusively on the subject. If you run out of space, you can use the back of the pages.***

## Exercice 1. Course questions (4 points – no negatives)

Choose the correct answer(s):

**1.** Millman's theorem comes from:

a. The nodes law
b. The law of meshes

**2.** What is the unit of the capacitance $C$ of a capacitor?

a. Ohm $(\Omega)$
b. Farad $(F)$
c. Henry $(H)$
d. Mathieu $(M)$

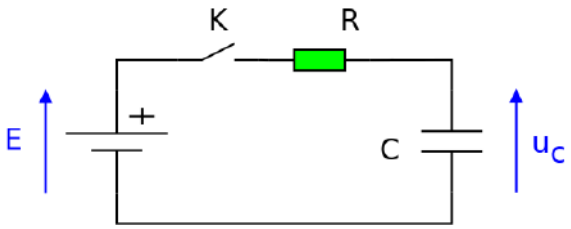
**3.** What is the unit of the inductance $L$ of a coil ?

a. Ohm $(\Omega)$
b. Farad $(F)$
c. Henry $(H)$
d. Mathieu $(M)$

**4.** In continuous steady state (DC), a coil can be replaced by:

a. a capacitor
b. an open switch
c. a wire
d. a resistor

Consider the next circuit, where $E$ is a source of DC voltage. The capacitor is initially discharged. At $t = 0$, we close the switch K




**5.** What is worth $u_C$ right after closing K.

a. 0 b. $E$ c. $\frac{E}{R}$ d. $R.E$

**6.** What is worth $u_C$ when the steady state is reached.

a. 0 b. $E$ c. $\frac{E}{R}$ d. $R.E$

## Exercice 2. Transitional arrangements (10 points)

Consider the next circuit. The switch has been open long enough for all currents to be zero.

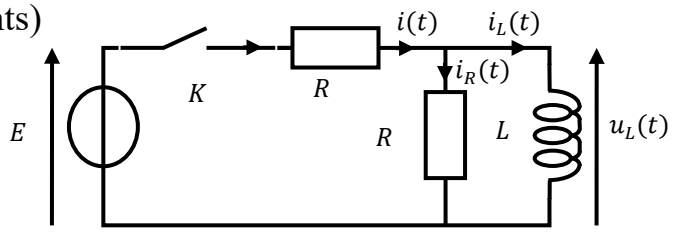



**Figure 1**

At t = 0, the switch K is closed.

1. Complete the following table:

| | $i$ | $i_R$ | $i_L$ | $u_L$ |
|---|---|---|---|---|
| $t = 0^+$ | | | | |
| $t \to \infty$ | | | | |

2. We want to determine the equation of the voltage $u_L(t)$ across the coil. For this, we will try to simplify the circuit, using the Thévenin/Norton equivalences.
   a. Determine $E_{th}$ and $R_{th}$ so that the circuit in Figure 2 is equivalent to that in Figure 1.

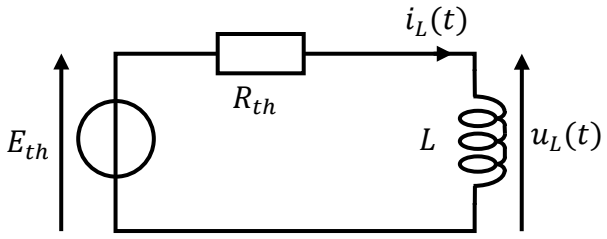
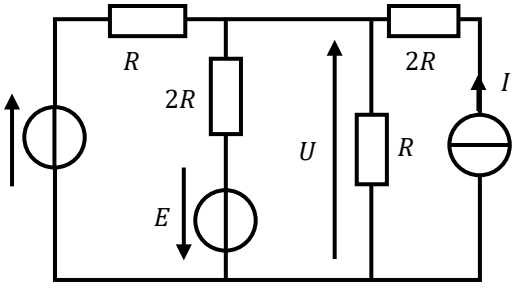



**Figure 2**

b. Using the previous results (Figure 2 diagram), establish the differential equation that describes the evolution of $u_L$ over time, and then determine the expression of $u_L(t)$. You will give this equation as a function of $E$, $R$ and $L$. What is the time constant $\tau$ of this circuit?


## Exercice 3. Millman's theorem (6 points)

1. Consider the circuit opposite. Using Millman's theorem, determine the expression of the voltage $U$.



2. Consider the circuit opposite. Using Millman's theorem, determine the expression of the voltage $U$.