Last name .... First name .... Group : ....

Electronics Test

Calculators and documents are not allowed. The points scale is given as an indication.
Answer exclusively on the questions sheets. If you run out of space, you can use the back of the pages.

Exercise 1 : MCQ (3 Points - No negative point)

Select the correct answer(s)

1. Consider an inductor of inductance L. We note $u(t)$, the voltage across it and $i(t)$, the current through it. We use the passive convention to orient current and voltage. Select the correct expression:

a. $u(t) = \frac{1}{L}.\frac{di(t)}{dt}$

b. $i(t) = \frac{1}{L}.\frac{du(t)}{dt}$

c. $u(t) = L.\frac{di(t)}{dt}$

d. $i(t) = L.\frac{du(t)}{dt}$

2. Capacitance C of a capacitor has for unit

a. Ohm (Ω)

b. Henry (H)

c. Farad (F)

d. Newton (N)

3. In DC regime, a capacitor behaves like

a. a wire

b. an open switch

c. a resistance

d. an inductor

4. In DC regime, an inductor behaves like

a. a wire

b. an open switch

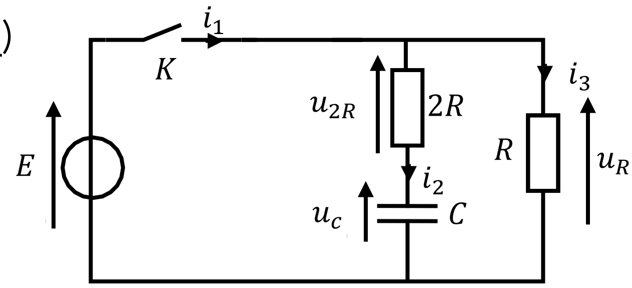
c. a resistance

d. an inductor

5. What are the correct statements (2 answers)

a. Current flowing through a capacitor cannot vary abruptly.
b. Voltage across a capacitor cannot vary abruptly.
c. Current flowing through an inductor cannot vary abruptly.
d. Voltage across an inductor cannot vary abruptly.

Exercise 2 : Transcient sate (12 Points)



Consider the circuit opposite. For t<0, the capacitor of capacitance C is discharged.

A. At t=0, K switch is closed.

1. Qualitative study : Fill in the following table. Express non-zero results in terms of E and R.

	$i_2(t)$	$u_R(t)$	$u_C(t)$	$u_{2R}(t)$
$t = 0^+$				
$t \to \infty$				

2. Quantitative study :
   a. Show that the differential equation that allows to determine voltage across C is :

$$\frac{du_c}{dt} + \frac{1}{2RC}.u_c = \frac{E}{2RC}$$

Deduce the time constant τ of the circuit.

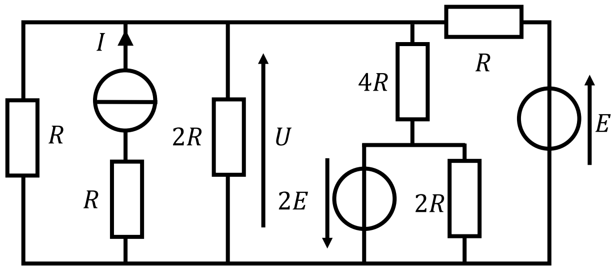
b. Solve this differential equation to deduce $u_C(t)$ expression.

B. Once the steady state is reached, we open the switch. We set then t'=0.

Fill in the following table. Express non-zero results in terms of E and R.

	$i_2(t')$	$u_R(t')$	$u_C(t')$	$u_{2R}(t')$
$t' = 0^+$				
$t' \to \infty$				

Exercise 3 : Millman theorem (5 Points)



Consider the diagram opposite. By means of Millman theorem, determine U expression. Express your result in terms of E, I and R. Simplify as much as possible your answer