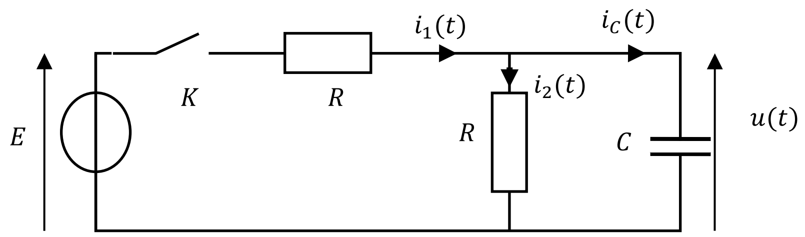
Partial Electronic

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. MCQ (9 points – no negative point)

Consider the circuit below. The switch is opened and the capacitor is discharged.



1. There is continuity of current in the capacitor.

   a. TRUE b. FALSE

2. At t = 0, we close the switch K. Complete the following table. You will express your answers based on E and R.

	i_1	i_2	u
$t = 0^+$			
$t \to \infty$			

Once steady state is established, the switch is opened.

3. We then consider $t' = 0$. Complete the following table. You will express your answers based on E and R.

	i_1	i_2	u
$t' = 0^+$			

4. What is the unit of the product $C\omega$?

a. Siemens
b. Hertz
c. Amps
d. Ohms

Consider a sinusoidal voltage $u(t) = U.\sqrt{2}.sin\,(\omega t + \varphi)$. Note $\underline{U}$, the complex amplitude associated with $u(t)$.

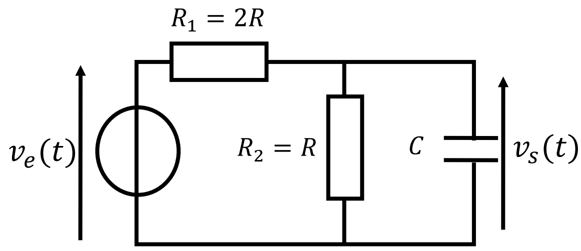
5. What can we say about U?

a. It is expressed in Ampere
b. It has no unity
c. It represents the maximum value of $u(t)$
d. It is expressed in Volt

6. What is the module of $\underline{U}$?

a. φ
b. ω
c. U
d. $\omega t + \varphi$

Consider the filter opposite, where $v_e(t) = V_E.\sqrt{2}.sin(\omega t)$. (Questions 7 to 10):



7. What is the complex impedance $\underline{Z_{eq}}$ of the dipole equivalent to the combination of R_2 and C ?

a. $\underline{Z_{eq}} = \frac{jRC\omega}{R+jC\omega}$
b. $\underline{Z_{eq}} = \frac{R}{1+jRC\omega}$
c. $\underline{Z_{eq}} = \frac{jC\omega}{1+jRC\omega}$
d. $\underline{Z_{eq}} = \frac{RC}{R+C}$

8. The complex amplitude of the voltage v_s is given by:

a. $\underline{V_S} = \frac{1}{3-2jRC\omega} V_E$
b. $\underline{V_S} = \frac{V_E \sin(\omega t)}{3+2jRC\omega}$
c. $\underline{V_S} = \frac{1}{3R+jC\omega} V_E$
d. $\underline{V_S} = \frac{1}{3+2jRC\omega} V_E$

9. What type of filter is it?

a. High Pass
b. Band Pass
c. Low Pass
d. Band Stop

10. What filter do you get if you replace R_2 with a coil?

a. Low Pass
b. Band Pass
c. Band Stop
d. High Pass

Exercice 2. Forced sinusoidal regime: Study of a filter (11 points)

Consider the following circuit, where $R' = R$:

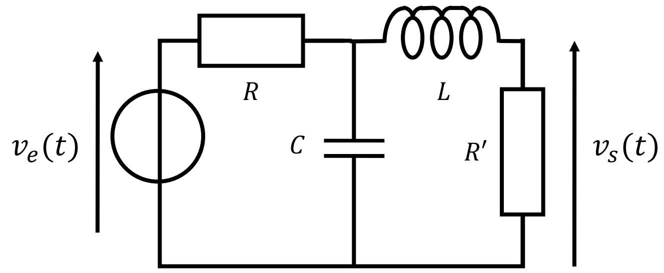


Figure 1

1. Qualitative study:
   a. Give an equivalent diagram in very low frequency (VLF) of this filter. From this deduce the limit of the voltage v_s of this filter in VLF.

   b. Give an equivalent diagram in very high frequency (VHF) of this filter. From this deduce the limit of the voltage v_s of this filter in VHF.

   c. Conclude on the nature and order of this filter.

d. What type of filter do you get if you invert the coil and capacitor? Justify your answer.

2. Quantitative study:

a. Determine $\underline{E_{th}}$ and $\underline{Z_{th}}$ so that the previous circuit (Figure 1) is equivalent to this one below. Detail your reasoning.

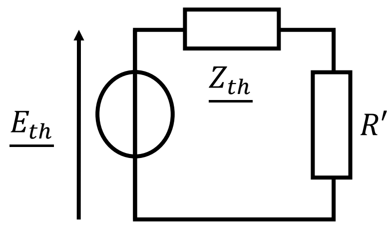


Figure 2

b. Using the diagram in Figure 2, express the complex amplitude $\underline{V_S}$ associated with the voltage $v_s(t)$ as a function of $\underline{E_{th}}$ and $\underline{Z_{th}}$ then, as a function of R, L, C, ω and $\underline{V_E}$. From this deduce the transfer function $T(\omega)$ of the filter, as well as its amplification $A(\omega)$.