EPITA / InfoS2 Februrary 2017

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

Mid-term exam of Electronics

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

Answers to be written on this document only. If you need more space, you can use the back of the sheets.

Exercise 1. Lecture questions (5 points – without negative points)

Choose the correct answers :

We consider a sinusoidal current $i(t) = I\sqrt{2}.sin\ (\omega t + \varphi)$

1. By convention, I is any real quantity in Ampere.

a. True b. False

2. Choose the correct formula. T represents the period of $i(t)$ and f its frenquency.

a. $\omega = 2.\pi.T$ c. $f = 2.\pi.\omega$

b. $\omega.T = 2.\pi$ d. $\frac{\omega}{T} = \frac{2.\pi}{f}$

We note $\underline{I}$ the complex amplitude of $i(t)$.

3. What is the modulus of $\underline{I}$?

a. $< i >$ c. $2.I$

b. I d. $I.\sqrt{2}$

4. What is the argument of $\underline{I}$?

a. $\omega t + \varphi$ c. ωt

b. φ d. I

5. Which formula represents the complex impedance of a capacitor C?

a. $-jC\omega$ b. $\frac{-1}{jC\omega}$ c. $\frac{1}{jC}$ d. $\frac{-j}{C\omega}$

6. For a capacitor, the voltage is :

a. In advance of $\frac{\pi}{2}$ compared to the current

b. Delayed of $\frac{\pi}{2}$ compared to the current

c. In phase with the current

7. $\frac{1}{C\omega}$ is homogeneous to :

a. Ω c. s

b. S d. Without unit

8. Which formula represents the complex impedance of an inductor L?

a. jL b. $\frac{1}{jL\omega}$ c. $jL\omega$ d. $\frac{-j}{L\omega}$

9. For an inductor, the current is :

a. In advance of $\frac{\pi}{2}$ compared to the voltage.

b. Delayed of $\frac{\pi}{2}$ compared to the voltage.

c. In phase with the volatge.

10. What is the unit of $LC\omega^2$?

a. Ω c. s

b. S d. Without unit

Exercise 2. Identification of a two-terminal circuits (3 points)

We want to determine the type of the unkown two-terminal. For that, we measure the voltage across its terminals $u(t)$ and the current $i(t)$ flowing through it.

Determine the type of the two-terminal and its characteristic value (the value of R for a resistor, the value of C for a capacitor and the value of L for an inductor) for each following case : (justify your answer)

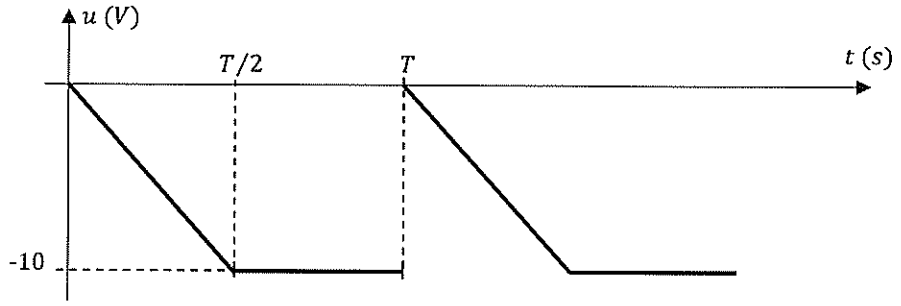
1. $u(t) = U_{Max}.sin(\omega t)$ and $i(t) = I_{Max}.sin\left(\omega t - \frac{\pi}{2}\right)$ where $\begin{cases} \omega = 1000\, rd/s \\ U_{Max} = 10\, V \\ I_{Max} = 10.10^{-3}\, A \end{cases}$.

2. $u(t) = U_{Max}\, sin(\omega t)\ and\ i(t) = I_{Max}.cos\left(\omega t - \frac{\pi}{2}\right)$ where $\begin{cases} \omega = 1000\ rd/s \\ U_{Max} = 10\ V \\ I_{Max} = 5.10^{-3}\ A \end{cases}$.

3. $u(t) = U_{Max}.\sin(\omega t)$ and $i(t) = I_{Max}.cos(\omega t)$ where $\begin{cases} \omega = 1000\ rd/s \\ U_{Max} = 5\ V \\ I_{Max} = 10.10^{-3}\ A \end{cases}$.

Exercise 3. RMS and average values (4 points)

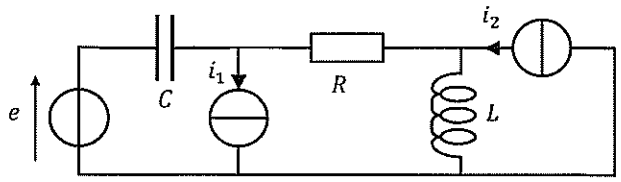
Express $u(t)$ for $t \in [0; T]$ (T = period of the signal) before computing the average value and the RMS value of the following signal : (justify your answer)



Exercise 4. Sinusoidal regime (8 points)

We consider the following circuit :

Where $\begin{cases} i_1(t) = I\,cos(\omega t) \\ i_2(t) = I\,sin(\omega t) \\ e(t) = E\,sin\,(\omega t) \end{cases}$



We assume that I, E, ω, L, R and C are known.

1. Determine the complex amplitudes associated to $i_1(t)$, $i_2(t)$ and $e(t)$.

2. Express the current $i(t)$ flowing through R.

Rq : you have to start by representing this current on the circuit. Then, you can use the method that you want (superposition, Thevenin and/or Norton) in order to determine I. If necessary, you can draw the equivalent diagram associated to each step in order to justify your answer (using the superposition theorem for example).