UMMTO
Département automatique
L2A

Mai 2021
durée:1h30

EMD d'électronique fondamentale

Exo1 : (7)pts

Soit le circuit de la fig.1.

1. donner le circuit de Thévenin équivalent vu entre les deux points A et B ?
2. calculer Rth et Eth ?
3. Calculer Ic ? (courant qui traverse Rc).
4. calculer la tension aux bornes de Rc ?

AN : R1=R2=4Ω, R3=3,R4=5Ω, Rc=2Ω, E1=10V , E2=5V, I=1A.

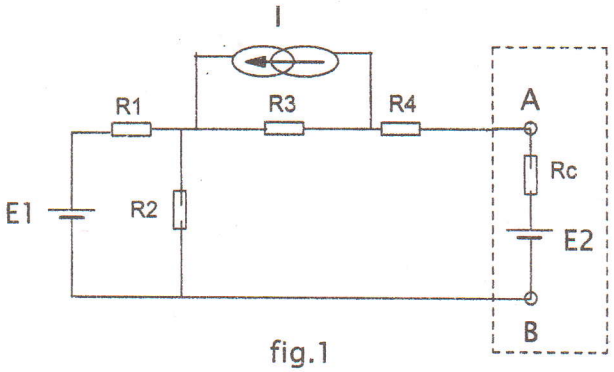


fig.1

Exo2 : (7) pts

Soit Q le quadripôle de la fig.2.

1.Calculer la matrice chaine du quadripôle Q1 ?

2.Déduire la matrice chaine du quadripôle Q2 ?

3.Donner la matrice chaine du quadripôle Q ?

4.Donner la fonction de transfert V2/V1 quand I2 =0 ?

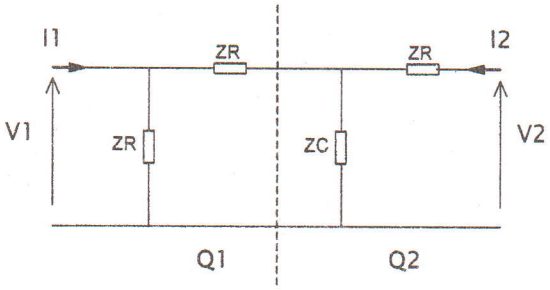


fig.2

5.Ce quadripôle est- il un filtre ? (justifier).

6.Si oui, donner sa nature ? (justifier sans faire d'étude)

Exo3 : (6) pts

Soit le circuit de la fig.3. On considère la diode idéale.

1. Calculer la tension aux bornes de R2 ?
2. calculer le courant I2 qui traverse R2 ?

AN : E1=5V, E2=1V , R1=2Ω, R2=3Ω et R3=1Ω.

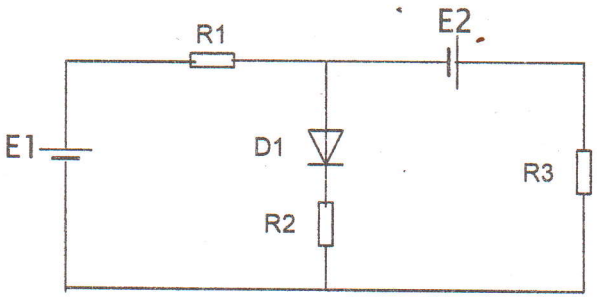


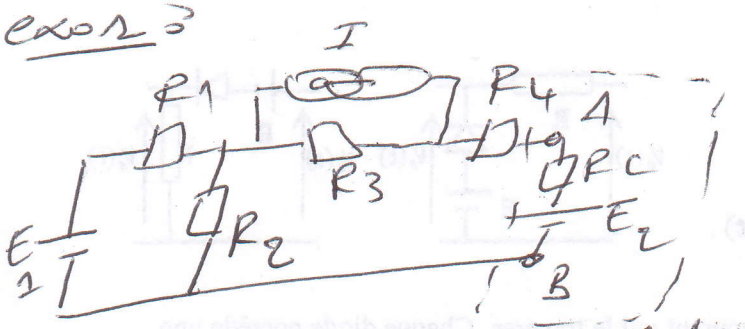
fig.3

Proposé par Mme ZAABOT.Z

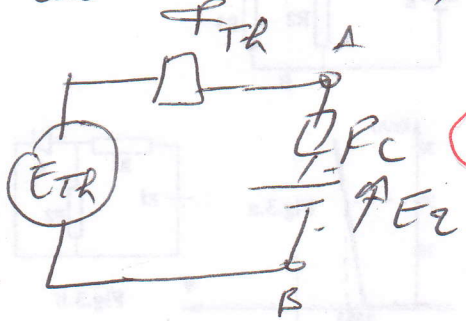
BON COURAGE

Correction de l'EMD ELN 2022

exo 2 :



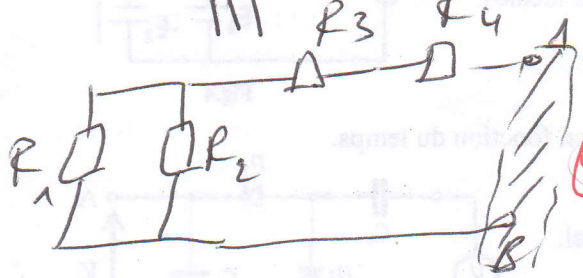
1) Circuit de Thévenin équivalent :



0,5

2) Calcul de R_{Th} 0,5

$R_{Th} = R_{eq} \ (E_1 = 0, \ I = 0)$.

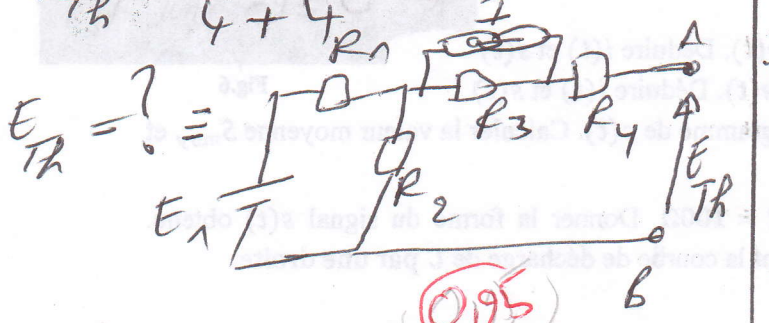


0,25

$$R_{Th} = \frac{R_1 . R_2}{R_1 + R_2} + R_3 + R_4 .$$ 0,5

A.N :

$$R_{Th} = \frac{4 . 4}{4 + 4} + 3 + 5 = 10\ \Omega$$ 0,25

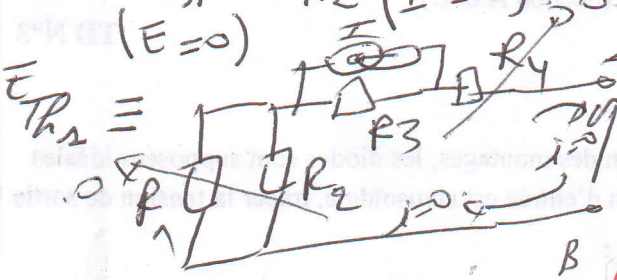


0,25

$E_{Th} = E_{Th_1} + E_{Th_2} \ (I = 0)$ 0,5

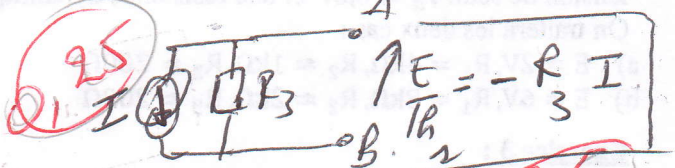
$(E = 0)$

$E_{Th_2} \equiv$



0,25

III

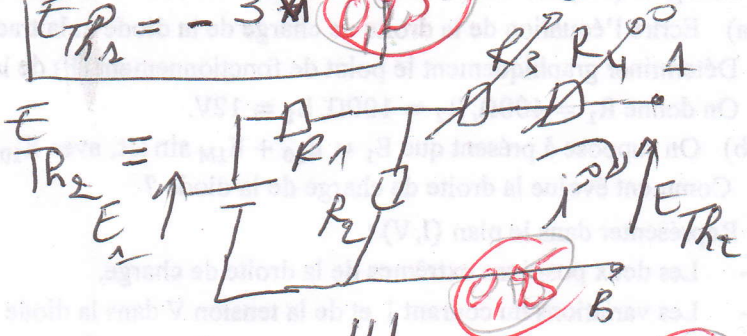


0,25 0,5

A.N :

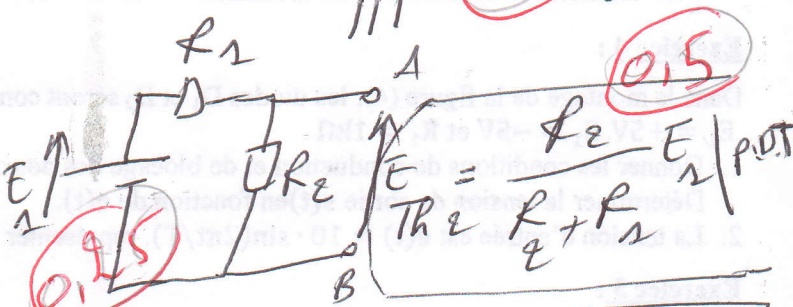
$E_{Th_2} = -3\ V$ 0,25

$E_{Th_2} \equiv$



0,25

III



0,25 0,5

A.N :

$$E_{Th_2} = \frac{4 \times 10}{4 + 4} = \frac{40}{8} = 5\ V$$ 0,25

$E_{Th} = 5 - 3 = 2\ V = E_{Th}$ 0,25

3) $i_C = \dfrac{E_{Th} - E_2}{R_{Th} + R_C}$ 0,5

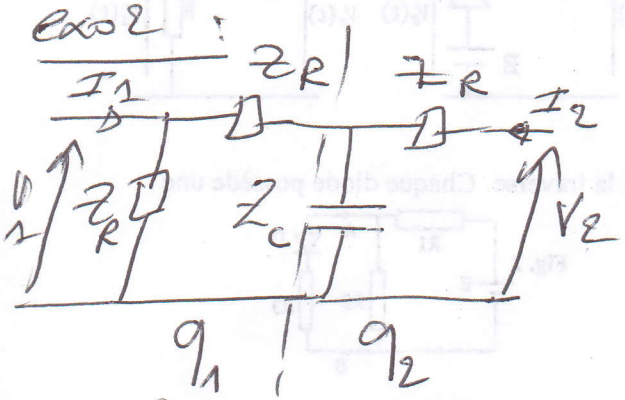
A.N : $i_C = \dfrac{2 - 5}{10 + 2} = \dfrac{-3}{12} = -\dfrac{1}{4}$

$i_C = -0,25\ A$ 0,25

$$u_{RC} = i_C \cdot R_C = -\frac{1}{4} \cdot 2 = -0{,}5\,V$$ (0,5)

$$\boxed{u_{RC} = -0{,}5\,V}$$ (0,25)

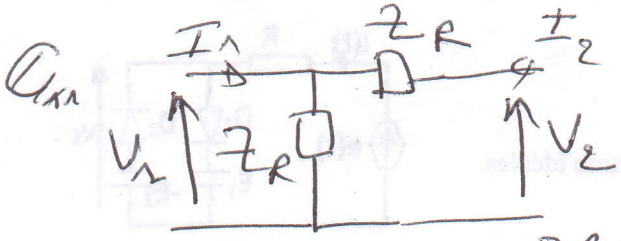
exo 2 :



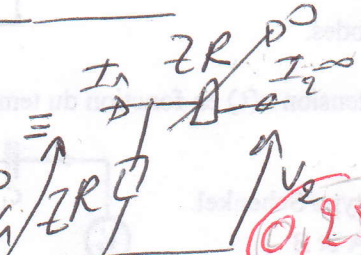
1) Calcul $[C_1]$.

$$V_1 = C_{11} V_2 - C_{12} I_2$$
$$I_1 = C_{21} V_2 - C_{22} I_2$$

C_{11}



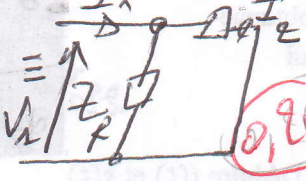
$$C_{11} = \frac{V_1}{V_2}\Big|_{I_2=0}$$ (0,25)



(0,25)

$$V_2 = V_2 \Rightarrow \boxed{C_{11} = 1}$$ (0,25) (0,25)

$$C_{12} = \frac{V_1}{-I_2}\Big|_{V_2=0}$$ (0,25)

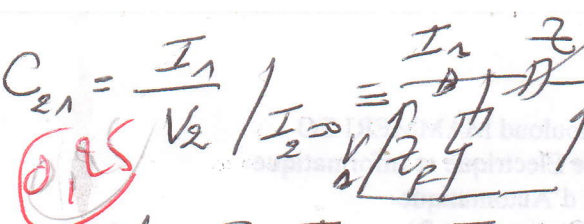


(0,25)

$$V_1 = -Z_R I_2 \Rightarrow \frac{V_1}{-I_2} = Z_R$$ (0,25)

$$\boxed{C_{12} = Z_R}$$ (0,25)

$$C_{21} = \frac{I_1}{V_2}\Big|_{I_2=0}$$ (0,25)

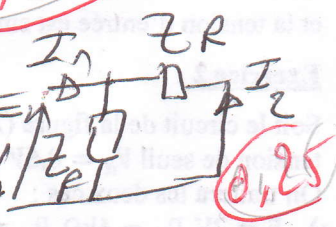


(0,25)

$$\Rightarrow V_2 = Z_R I_1 \Rightarrow \frac{I_1}{V_2} = \frac{1}{Z_R}$$ (0,25)

$$\boxed{C_{21} = \frac{1}{Z_R}}$$ (0,25)

$$C_{22} = \frac{I_1}{-I_2}\Big|_{V_2=0}$$ (0,25)



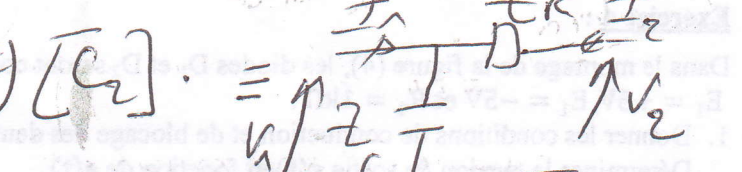
(0,25)

$$I_2 = -\frac{Z_R}{Z_R + Z_R} I_1 \Rightarrow \frac{I_1}{-I_2} = \frac{2Z_R + Z_R}{Z_R}$$ (0,25)

$$\boxed{C_{22} = 2}$$ (0,25)

$$[C_1] = \begin{bmatrix} 1 & Z_R \\ \frac{1}{Z_R} & 2 \end{bmatrix}$$ (0,25) (0,25)

2) $[C_2]$.



$$[C_2] = \begin{bmatrix} 1 & Z_R \\ \frac{1}{Z_C} & \frac{Z_C + Z_R}{Z_C} \end{bmatrix} = \begin{bmatrix} 1 & R \\ jCw & jCwR + 1 \end{bmatrix}$$ (0,25)

$$[C_2] = \begin{bmatrix} 1 & R \\ jCw & (RjCw + 1) \end{bmatrix}$$ (0,25)

3) $[C] = [C_1][C_2]$ (0,25)

$$= \begin{bmatrix} 1 & R \\ \frac{1}{R} & 2 \end{bmatrix} \begin{bmatrix} 1 & R \\ jCw & (RjCw+1) \end{bmatrix}$$

$$[C] = \begin{bmatrix} (1+jRC\omega) & [R+R(RjC\omega+1)] \\ \left[\frac{1}{R}+2jC\omega\right] & [1+2(RjC\omega+1)] \end{bmatrix}$$

$$[\ ] = \begin{bmatrix} (2+jRC\omega) & (2R+jR^2C\omega) \\ \left(\frac{1}{R}+2jC\omega\right) & (3+2jRC\omega) \end{bmatrix}$$

0,5

2) $F(j\omega) = \frac{V_2}{V_1}\Big/_{I_2=0}$

$V_1 = C_{11}V_2 - C_{12}\cancel{I_2}^{0}$

$\Rightarrow \frac{V_1}{V_2} = C_{11} \Rightarrow \frac{V_2}{V_1} = \frac{1}{C_{11}}$ 0,25

$\Rightarrow \boxed{F(j\omega) = \frac{V_2}{V_1} = \frac{1}{1+jRC\omega}}$

3) c'est un filtre parceque 0,25
~~c'est~~ F est en fonction de ω

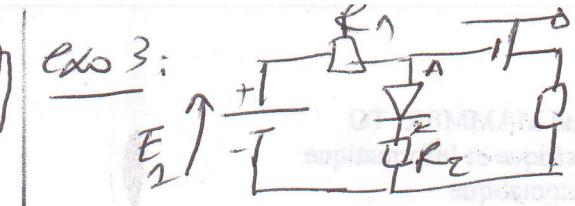
$\omega \to 0 \Rightarrow F = 1$

$\omega \to \infty \Rightarrow F = 0$. 0,5

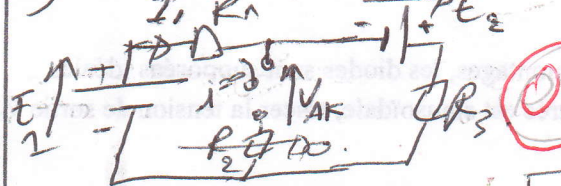
$\Rightarrow$ C'est un filtre passe bas.

puisque F est grand pour les $\omega \to 0$ (petites fréquences) 0,25

Exo 3:



a) Calcul de $V_{AK} = ?$ (l'état de la D)



0,5

$\boxed{V_{AK} = R_3 I_1 - E_2} = \boxed{E_1 - R_1 I_1}$

$\Rightarrow$ Calcul $I_1 = ?$ méthode 1

$\boxed{I_1 = \frac{E_1 + E_2}{R_1 + R_3}} = \frac{5+1}{2+1} = 2\,A$ 0,5

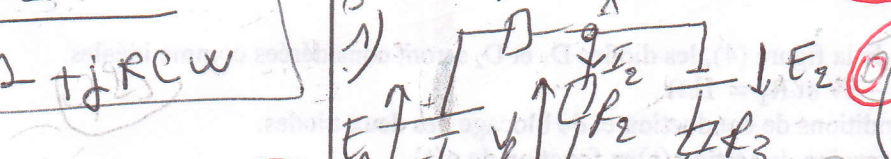
$V_{AK} = 1.2 - 1 = \boxed{1\,V = V_{AK}}$

$V_{AK} = 1 \Big\} V_J = 0 \Rightarrow D$ (passante) 0,25

///

0,25

b)



0,5 (millmann)

méthode 1

$V_{R_2} = V_{AB} = V_A - V_B = V_A = \dfrac{\frac{E_1}{R_1} + \frac{0}{R_2} + \frac{(-E_2)}{R_3}}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$

A.N

$V_{R_2} = \dfrac{\frac{5}{2} + \frac{0}{3} - \frac{1}{1}}{\frac{1}{2} + \frac{1}{3} + \frac{1}{1}} = \dfrac{\frac{3-2}{2}}{\frac{3+2+6}{6}}$

$V_{R_2} = \frac{3 \times 3}{11} = \frac{9}{11} \cong 0,82\,V$

0,5

c) $V_{R_2} = R_2 I_2 \Rightarrow I_2 = \frac{V_{R_2}}{R_2} = 0,27$

1 $\boxed{I_2 = 0,27\,A}$ 0,5