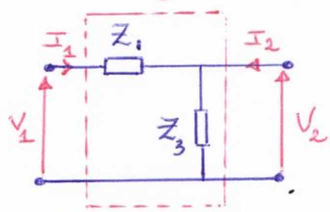
L2 / TTL / TS 321

Le : 30. 01. 2020

Mme. ABRI H.

- Corrigé -

Exercice 01 : (07 pts)



1. Paramètres Impédance (Z_{ij}) :

$$\begin{cases} V_1 = Z_{11} I_1 + Z_{12} I_2 \\ V_2 = Z_{21} I_1 + Z_{22} I_2 \end{cases}$$

$Z_{11} = \left.\dfrac{V_1}{I_1}\right|_{I_2=0} = (Z_1 + Z_3)$ (0,25) → impédance d'entrée (0,25) lorsque la sortie est en circuit-ouvert.

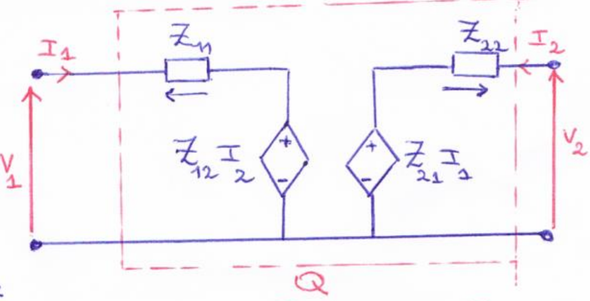
$Z_{12} = \left.\dfrac{V_1}{I_2}\right|_{I_1=0} = Z_3$ (0,25) → impédance de transfert inverse (0,25) lorsque l'entrée est en circuit-ouvert.

$Z_{21} = \left.\dfrac{V_2}{I_1}\right|_{I_2=0} = Z_3$ (0,25) → impédance de transfert directe (0,25) lorsque la sortie est en circuit-ouvert.

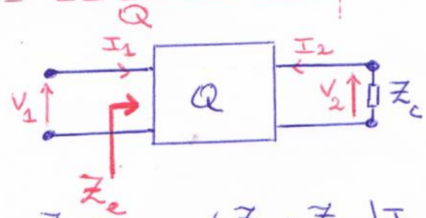
$Z_{22} = \left.\dfrac{V_2}{I_2}\right|_{I_1=0} = Z_3$ (0,25) → impédance de sortie (0,25) lorsque l'entrée est en circuit-ouvert.

(0,25)

Schéma équivalent :



2. Impédance d'entrée Z_e



$$\begin{cases} V_1 = Z_{11} I_1 + Z_{12} I_2 \quad \cdots (1) \\ V_2 = Z_{21} I_1 + Z_{22} I_2 \quad \cdots (2) \end{cases}$$ (0,25)

$V_2 = - Z_c I_2 \quad \cdots (3)$ (0,25)

$(2) = (3) \Rightarrow Z_{21} I_1 + Z_{22} I_2 = - Z_c I_2 \Rightarrow Z_{21} I_1 = -(Z_c + Z_{22}) I_2$

$\Rightarrow I_2 = - \dfrac{Z_{21}}{Z_c + Z_{22}} I_1$ (0,25)

$(1) \Rightarrow V_1 = Z_{11} I_1 + Z_{12} \left(- \dfrac{Z_{21}}{Z_c + Z_{22}} I_1 \right)$

$\Rightarrow V_1 = \left(Z_{11} - \dfrac{Z_{12} Z_{21}}{Z_c + Z_{22}} \right) I_1$

$$\boxed{Z_e = \frac{V_1}{I_1} = Z_{11} - \frac{Z_{12} Z_{21}}{Z_c + Z_{22}}}$$ (0,25) (0,25)

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• Gain en tension G_v :

$V_2 = Z_{21} I_1 + Z_{22} I_2 = - Z_c . I_2$

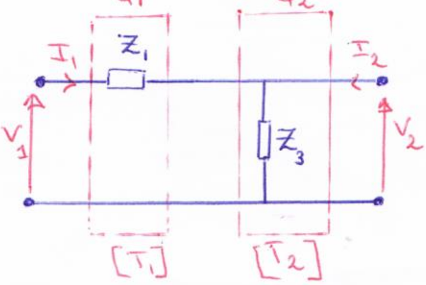
$$\Rightarrow I_1 = - \frac{(Z_c + Z_{22})}{Z_{21}} I_2$$

$V_1 = Z_{11} I_1 + Z_{12} I_2$

$$= \left[Z_{11} \left(- \frac{Z_c + Z_{22}}{Z_{21}} \right) + Z_{12} \right] I_2$$

$$G_v = \frac{V_2}{V_1} = \frac{- Z_c I_2}{\left\{ \frac{- Z_{11} Z_c - Z_{11} Z_{22} + Z_{12} Z_{21}}{Z_{21}} \right\} I_2} = \frac{Z_c Z_{21}}{Z_{11} Z_c + Z_{11} Z_{22} - Z_{12} Z_{21}}$$ (0,25) (0,25)

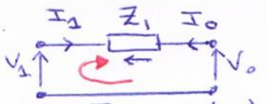
3. Matrice [T] :



On a :

02 quadripôles montés en cascade ;

Donc : $[T] = [T_2] [T_1]$ (0,25)



$$\begin{pmatrix} V_0 \\ I_0 \end{pmatrix} = \begin{pmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{pmatrix} \begin{pmatrix} V_1 \\ -I_1 \end{pmatrix}$$

$$\begin{cases} V_0 = T_{11} V_1 - T_{12} I_1 \\ I_0 = T_{21} V_1 - T_{22} I_1 \end{cases}$$

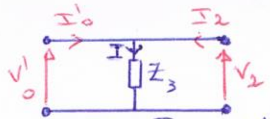
$I_0 = - I_1 \Rightarrow (T_{22} = 1$ et $T_{21} = 0)$ (0,25) (0,25)

$\Sigma V_i = 0 \Rightarrow V_1 = Z_1 I_1 + V_0$

$\Rightarrow V_0 = V_1 - Z_1 I_1$ (0,25)

$\Rightarrow (T_{11} = 1$ et $T_{12} = Z_1)$ (0,25) (0,25)

Donc : $[T_1] = \begin{pmatrix} 1 & Z_1 \\ 0 & 1 \end{pmatrix}$



$$\begin{pmatrix} V_2 \\ I_2 \end{pmatrix} = \begin{pmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{pmatrix} \begin{pmatrix} V'_0 \\ -I'_0 \end{pmatrix}$$

$$\begin{cases} V_2 = T_{11} V'_0 - T_{12} I'_0 \\ I_2 = T_{21} V'_0 - T_{22} I'_0 \end{cases}$$

$V_2 = V'_0 \Rightarrow (T_{11} = 1$ et $T_{12} = 0)$ (0,25) (0,25)

$V'_0 = Z_3 I = Z_3 (I'_0 + I_2)$

$= Z_3 I'_0 + Z_3 I_2$

$Z_3 I_2 = V'_0 - Z_3 I'_0$

$\Rightarrow (T_{21} = \frac{1}{Z_3}$ et $T_{22} = 1)$ (0,25) (0,25)

Donc : $[T_2] = \begin{pmatrix} 1 & 0 \\ 1/Z_3 & 1 \end{pmatrix}$

Donc : $[T] = \begin{pmatrix} 1 & Z_1 \\ 1/Z_3 & \frac{Z_1}{Z_3} + 1 \end{pmatrix}$ (0,25)

4. Gain en courant G_I :

$$G_I = \frac{-1}{T_{11} + T_{21} Z_C}$$ (0,125)

A.N : $T_{11} = 1$, $T_{21} = \frac{1}{R}$, $Z_C = R$

$$G_I = -\frac{1}{1 + \frac{1}{R} R} = -\frac{1}{2}$$ (0,125)

Ou bien : $$G_I = -\frac{Z_{21}}{Z_{22} + Z_C} = -\frac{Z_3}{Z_3 + Z_C} = -\frac{R}{R+R} = -\frac{1}{2}$$ (0,125) (0,125)

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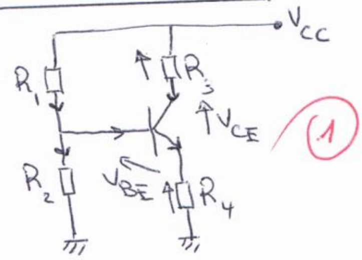
Exercice 03 06 pts

- C'est un montage Emetteur Commun car : (0,25)
  - L'entrée V_e est sur la base (0,25)
  - La sortie V_s est sur le collecteur (0,25)

- Modèle en statique :



(1)

- Droite de charge statique :

$$V_{cc} = R_3 I_E + R_4 I_E + V_{CE} \quad (0,5)$$

$$\begin{cases} I_C = \beta I_B & (0,25) \quad (\beta >> 1) \\ I_E = (\beta+1) I_B \simeq I_C & (0,25) \quad (0,25) \end{cases}$$

$$I_E = \left(\frac{\beta+1}{\beta}\right) I_C$$

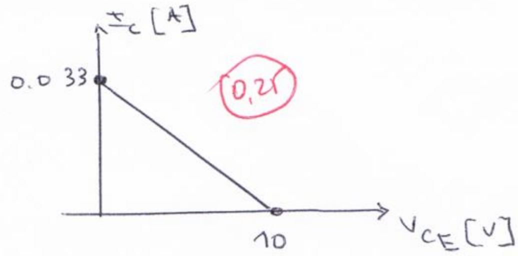
$$V_{cc} = (R_3 + R_4) I_E + V_{CE}$$

$$\Rightarrow -V_{CE} + V_{CC} = (R_4 + R_3) I_C$$

$$\Rightarrow \boxed{I_C = \frac{V_{cc}}{R_3+R_4} - \frac{V_{CE}}{R_3+R_4}} \quad (01)$$

A.N $\quad I_C = \frac{10}{300} - \frac{V_{CE}}{300} = 0.033 - 0.033\, V_{CE}$ (0,25)

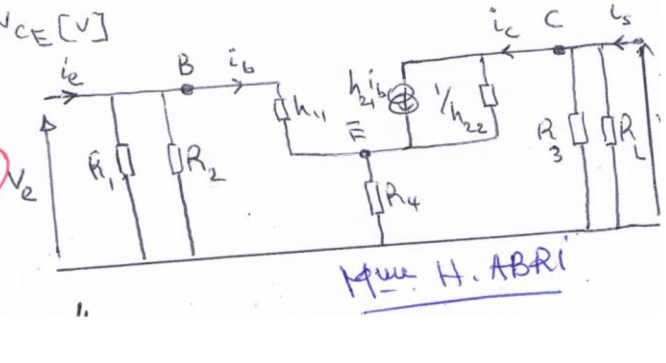
$$\begin{cases} V_{CE} = 0 \Rightarrow I_C = 0.033\ A & (0,25) \\ I_C = 0 \Rightarrow V_{CE} = 10V & (0,25) \end{cases}$$



(0,25)

- Schéma dynamique

(01 pt)



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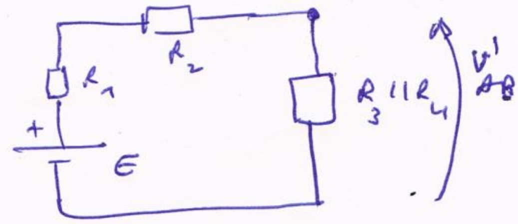
Exo. n° 1

$$V_{AB} = V'_{AB}\begin{pmatrix} E \neq 0 \\ \& \\ \dot{J} = 0 \end{pmatrix} + V''_{AB}\begin{pmatrix} \dot{J} \neq 0 \\ \& \\ E = 0 \end{pmatrix}$$ (1)

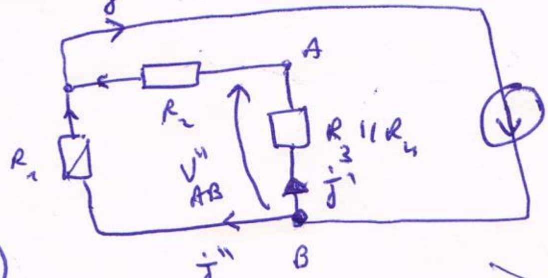
(1)

div. Tensi

(1,5) $$V'_{AB} = \frac{(R_3 \parallel R_4)}{(R_3 \parallel R_4) + R_1 + R_2} E$$



(2)

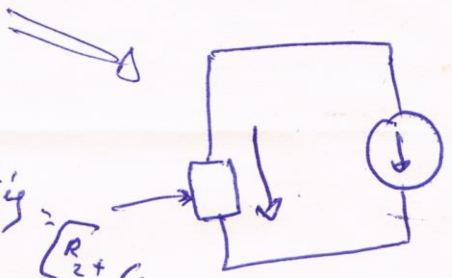


$$V_{AB} = V'_{AB} + V''_{AB}$$

(1,5)

$$V''_{AB} = -(R_3 \parallel R_4) \cdot \dot{J}'$$

div. courant $\dot{J}' =$



$$R'_4 = [R_2 + (R_3 \parallel R_4)] \parallel R_1$$

2 (3)

$$V_{AB} = (R_3 \parallel R_4) \cdot I \Rightarrow I =$$ (1)

$$I_3 = \frac{R_4}{R_3 + R_4} I$$ (1)

$$I_4 = \frac{R_3}{R_3 + R_4} \cdot I$$ (1)

Mr. Aitemaï A.