Xidian 2024-2025

TD 5 – Transistors CC

Question 1 : Polarisation

On considère l'étage amplificateur à transistor représenté sur la figure 1. On désire obtenir le point de polarisation suivant : I_C=0,5mA et V_{CE}=V_{CC}/2=3V.
Le gain statique en courant du transistor est β_0=100.

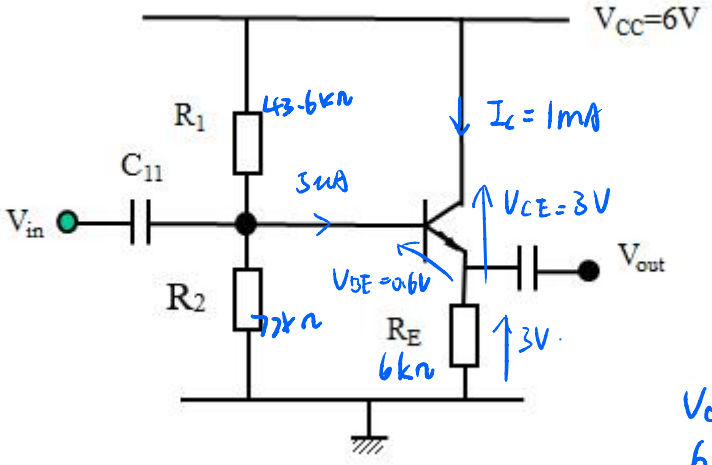


Figure 1

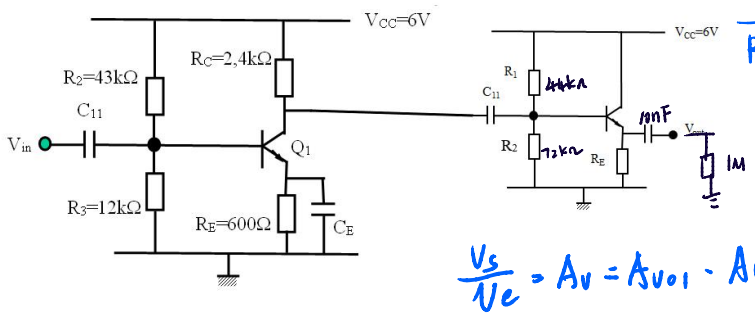
Déterminer R_1, R_2 et R_E pour avoir le point de polarisation voulue. On prendra I_{R2}=10I_B et donc I_{R1}=11I_B.

Question 2 : Faire le schéma équivalent petits signaux et basses fréquences.

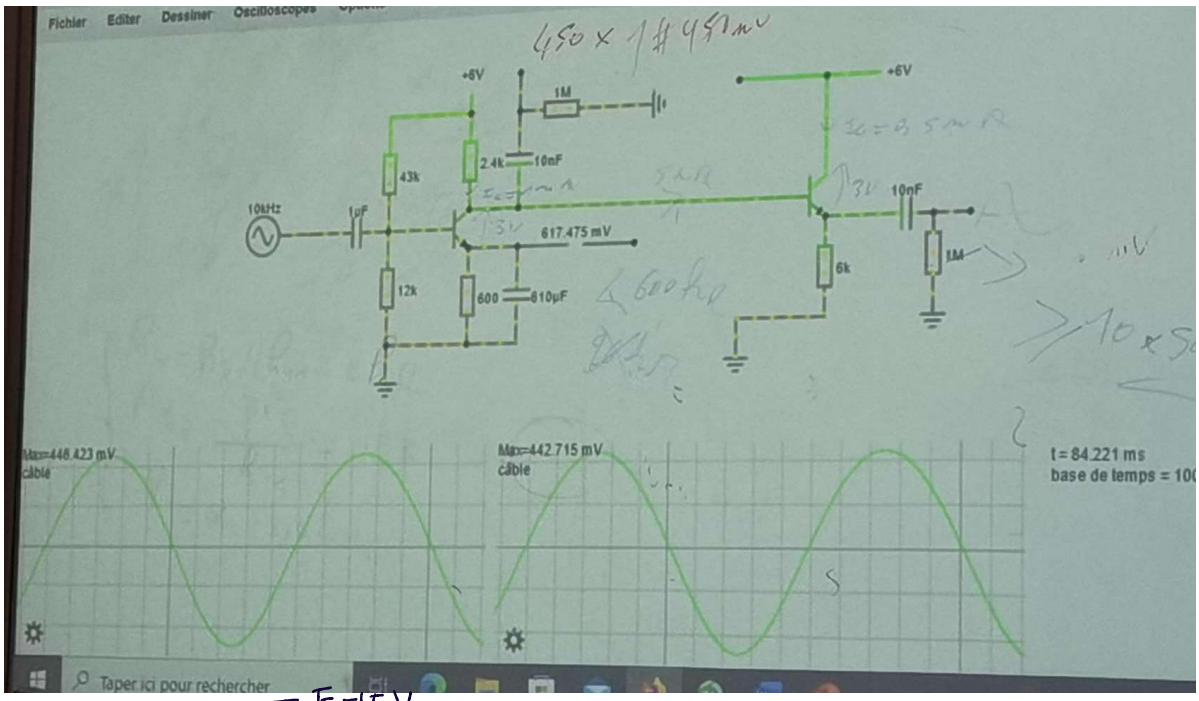
Déterminer le gain, la résistance d'entrée et le gain de ce montage.

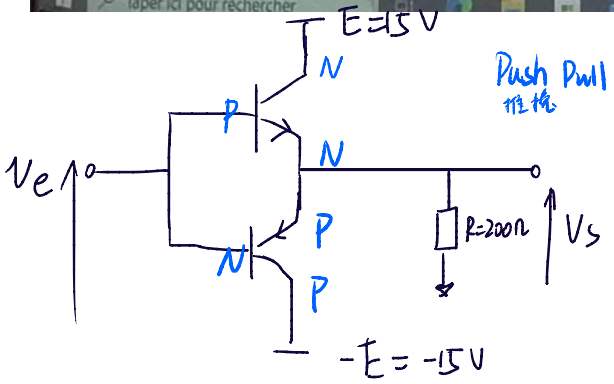
Question 3 : On désire cascader ce montage à l'amplificateur EC étudié au TD précédent.

Déterminer le gain, la résistance d'entrée et le gain de ce montage complet (EC + CC).

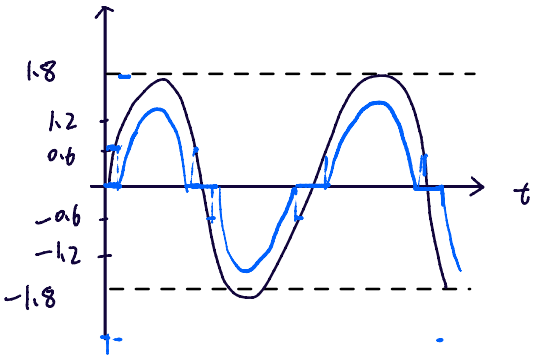


Proposer une solution plus simple de couplage !

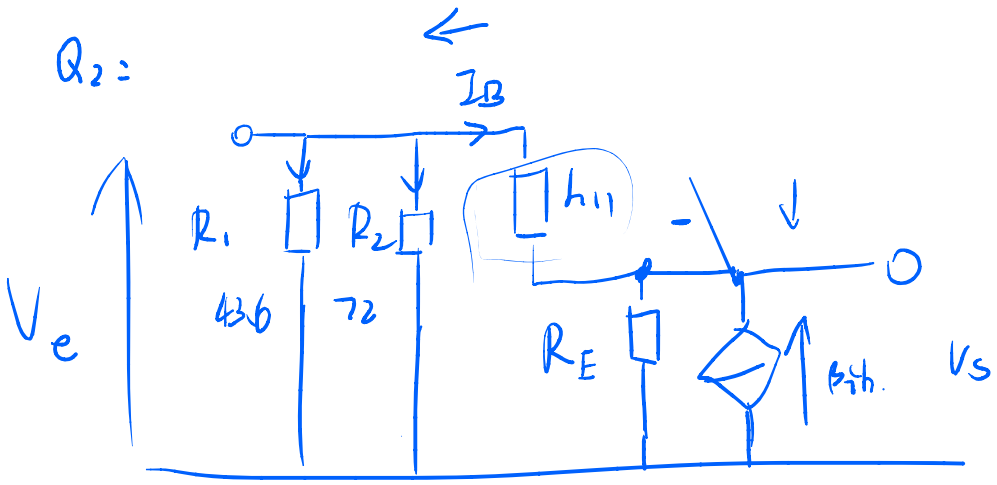

Fichier
Editer
Dessiner
+6V
1M
43k
2.4k
10nF
10kHz
1µF
617.475 mV
12k
600
810µF
6k
10nF
1M
Max=448.423 mV
câblé
Max=442.715 mV
câble
t = 84.221 ms
Taper ici pour rechercher


E=15V
N
P
N
P
N
P
Ve
R=200Ω
Vs
-E=-15V

Push Pull


1.8
1.2
0.6
-0.6
-1.2
-1.8
t

Q2:



$V_e = I_B h_{11} + (1+\beta) I_B R_E$ $\quad h_{11} = \beta \frac{U_T}{I_C} = 100 \times \frac{26mV}{0.5mA} = 5.2k\Omega$

$V_s = (1+\beta) I_B R_E$

$$A = \frac{V_s}{V_e} = \frac{h_{11} + (1+\beta) R_E}{(1+\beta) R_E} = \frac{5.2 + 111 \times 6}{111 \times 6} \simeq 1$$

V_e : Devin :

$$I_B = \frac{V_e + \beta I_B R_E}{h_{11}}$$

$$V_e = I_B h_{11} + \beta I_B R_E$$

$$V_e = I_B (h_{11} + \beta R_E)$$

$$I_B = \frac{V_e}{h_{11} + \beta R_E}$$

$$I_i = \frac{V_e}{h_{11} + \beta R_E} + \frac{V_e}{R_1} + \frac{V_e}{R_2}$$

$$R_i = R_1 \| R_2 \| (h_{11} + \beta R_E)$$

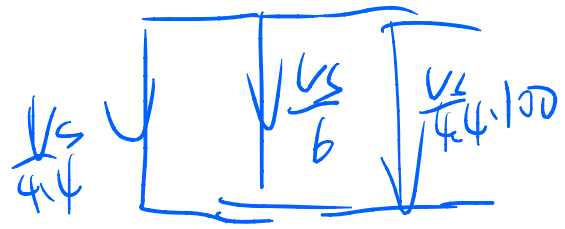
(5.2, 100, 6)

$\# \boxed{R_1 \| R_2} =$

$= 72 \| 436 \| 600$

$= 27 \| 600$

$= 25.8 \# 26k\Omega$



$\rightarrow V_s$: Devin

$$I = \frac{V_s}{4.4} + \frac{V_s}{6} + \frac{V_s}{4.4} \times 100$$

$$R_o = \frac{1}{\left(\frac{1}{4.4} + \frac{1}{6} + \frac{100}{4.4}\right) \times 10^{-3}} =$$

($\frac{100}{4.4} \simeq h_{11}$)

$\# \frac{4400}{100} = 44\Omega.$

$R_o \# \frac{h_{11}}{\beta} = 52\Omega$

$\rightarrow V_s$: Devin

$$I = \frac{V_s}{4.4} + \frac{V_s}{6} + \frac{V_s}{}$$

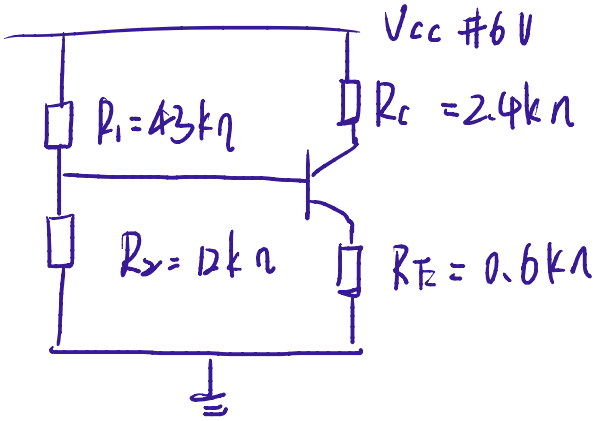
$$(101)\frac{V_s}{4.4} + \frac{V_s}{6}.$$

$$R_o = \frac{V_s}{V_s\left(\frac{101}{4.4} + \frac{1}{6}\right)} = 0.043$$

23 +

Q3 :

Q3 :



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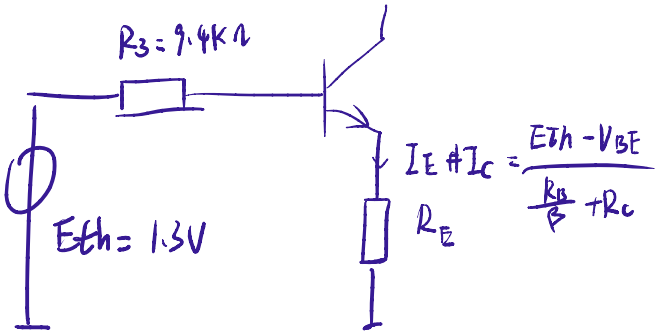
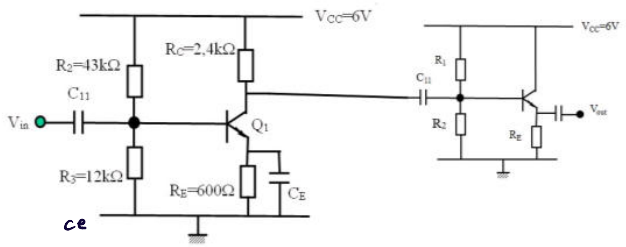


$$I_C = \frac{1.3 - 0.6}{\frac{9.4}{100} + 0.6} \approx 1\,mA .$$

Déterminer le gain, la résistance d'entrée et le gain de ce montage complet (EC + CC).



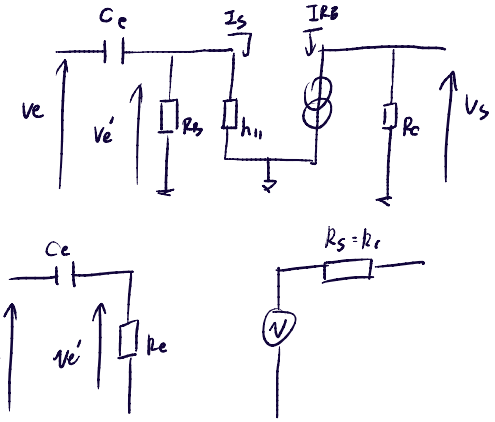
Proposer une solution plus simple de couplage !

$R_B = R_2 // R_3 =$

$R_e = R_B // h_{11} = 2\,k\Omega$

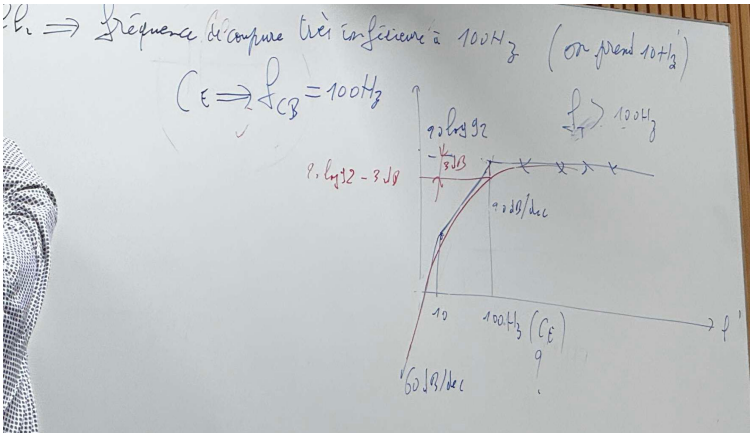
$R_S = R_C = 2.4\,\Omega$.

$A_V = \frac{\beta R_C}{h_{11}} \simeq -92$

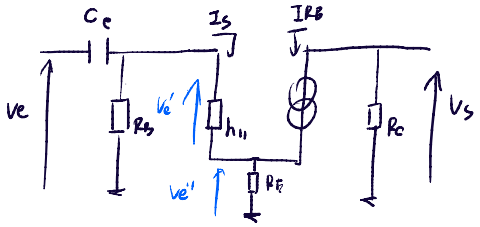


$\frac{V_e'}{V_s} = \frac{2j\pi f R_c C_e}{1 + 2j\pi f R_c C_e} =$

$f_{cB} = \frac{1}{2\pi R_c C_P} = 10\,Hz \Rightarrow C_P = \frac{1}{2\pi R_e f_{cB}}$



$h_{11} = \beta \frac{U_T}{I_C} \simeq 3\,6k\Omega$.



f_T = fréquence de

$|Z_{cE}| \ll R_E \quad |Z_{cE}| \leq \frac{R_E}{10} = 60\,\Omega$.

$Z_E = R_E // Z_{cE} \simeq Z_{cE}$

$Z_{cE} = \frac{1}{jC_E\omega} = \frac{1}{2j\pi f C_E}$

$|Z_{cE}| = \frac{1}{C_E\omega} = \frac{1}{2\pi f C_E}$

$V_e = V_e' + V_e''$

$V_e' = h_{11} \bar{i}_b$

$V_e'' = (\beta + 1) Z_{cE} \bar{i}_b$

$V_e \simeq V_e'$

$V_e' \gg V_e''$

$h_{11} \gg |\beta Z_{cE}| = \frac{\beta}{C_E\omega}$

$|Z_{cE}| \ll \frac{h_{11}}{\beta} \left(\leq \frac{h_{11}}{10\beta}\right)$

$\frac{1}{C_E 2\pi f} \leq \frac{h_{11}}{10\beta}$