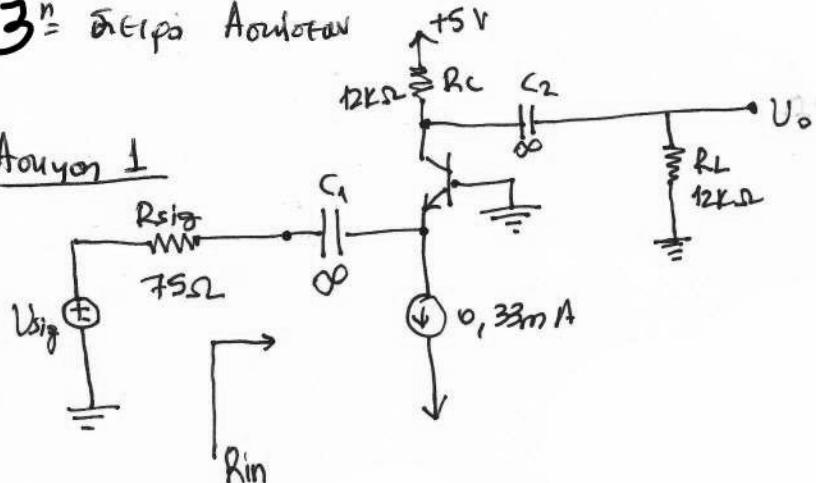


4ο Εξάμηνο, 2019-2020

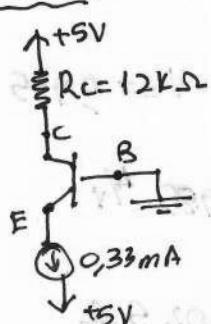
03117176

3^η Έτερη Αυτοταύ

Αυτογόνο 1



DC Ανάλυση:

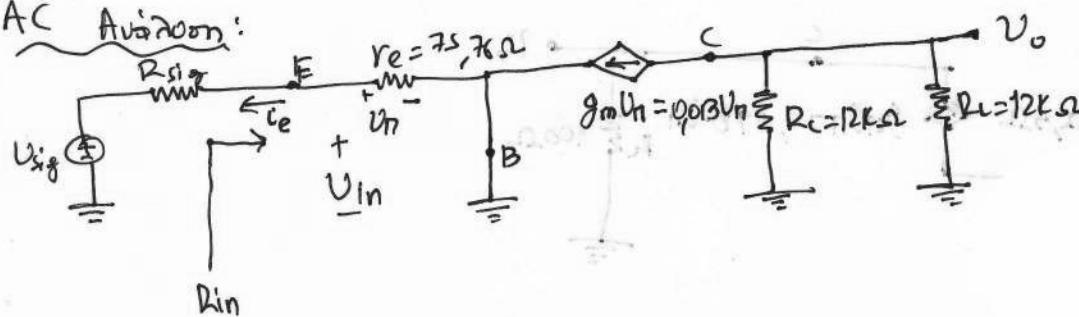


$I_E = 0,33 \text{ mA}$

$I_C = \alpha \cdot I_E = 0,3267 \text{ mA}$

$r_e = \frac{V_T}{I_C} = \frac{0,99 \cdot 25 \text{ mV}}{0,3267 \text{ mA}} = 75,76 \Omega$

AC Ανάλυση:

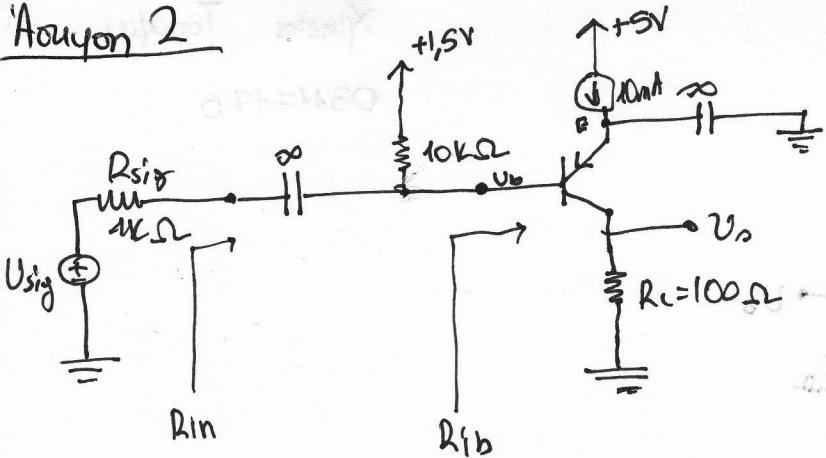


$$\frac{U_o}{U_{sig}} = \frac{R_C / R_L \cdot i_C}{U_{sig}} = \frac{R_C / R_L \cdot g_m V_n}{U_{sig}} = \frac{R_C / R_L \cdot g_m r_e \cdot i_e}{U_{sig}} = \frac{R_C / R_L \cdot g_m r_e U_{sig}}{(R_{sig} + r_e) \cdot U_{sig}}$$

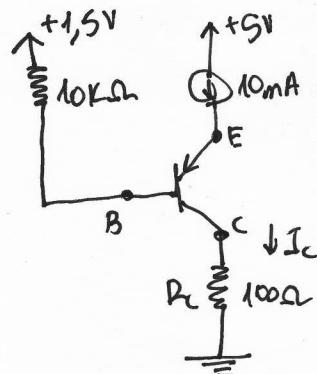
$$= \frac{R_C / R_L \cdot I_C \cdot \alpha \cdot V_T}{V_T \cdot I_C \cdot (R_{sig} + r_e)} = \alpha \frac{R_C / R_L}{R_{sig} + r_e} = 0,99 \frac{12k / 12k}{75\Omega + 75,76\Omega} = \frac{0,99 \cdot 6000}{150,76} = 39,4$$

$$R_{in} = \frac{U_{in}}{-i_e} = \frac{+i_{ere}}{+i_e} \Rightarrow R_{in} = r_e = 75,76 \Omega$$

Auflösung 2



DC Auflösung:



$$I_E = 10 \text{ mA}$$

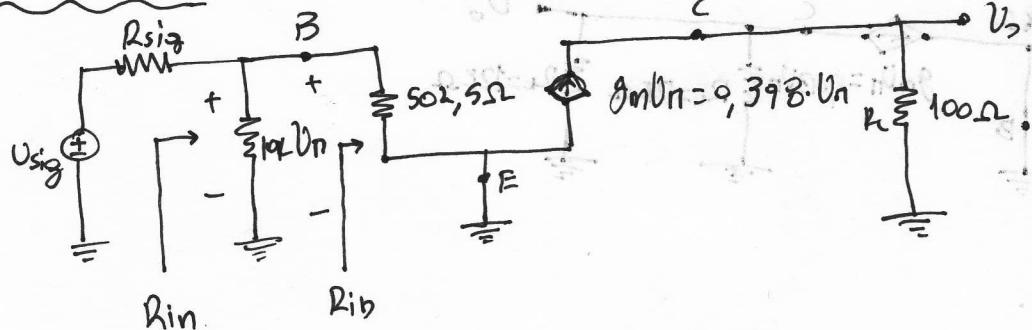
$$I_C = \frac{\beta}{\beta+1} I_E = \frac{200}{201} \cdot 10 \text{ mA} \Rightarrow I_C = 9,95 \text{ mA}$$

$$\text{NTK: } V_C = 100 \Omega \cdot I_C = 100 \cdot 9,95 \text{ mA} \Rightarrow V_C = 995 \text{ V}$$

$$g_m = \frac{I_C}{V_T} = \frac{9,95 \text{ mA}}{25 \text{ mV}} \Rightarrow g_m = 398 \text{ A/V}$$

$$r_D = \beta \frac{V_T}{I_C} = 200 \cdot \frac{25 \text{ mV}}{9,95 \text{ mA}} \Rightarrow r_D = 502,5 \Omega$$

AC Auflösung:



$$R_{in} = \frac{U_{in}}{I_{in}} = \frac{10k \parallel 502,5}{10k \parallel 502,5 + R_{sig}} \cdot \frac{U_{sig}}{U_{sig}} = 10k \parallel 502,5 \Rightarrow R_{in} = 478,45 \Omega = 0,478 k\Omega$$

$$R_{fb} + 10k \parallel 502,5$$

$$R_{fb} = \frac{U_{fb}}{I_{in}} = \frac{r_D \cdot \sqrt{5}}{\sqrt{5}} \Rightarrow R_{fb} = r_D = 502,5 \Omega$$

$$\frac{U_o}{U_{sig}} = \frac{R_{in}}{R_{in} + R_{sig}} = \frac{0,478}{0,478 + 1} = 0,323 \frac{\text{V}}{\text{V}}$$

$$\left\{ \begin{array}{l} \frac{U_o}{U_{fb}} = -g_m r_C = -3985 \cdot 100 = -39,85 \frac{\text{V}}{\text{V}} \\ \frac{U_o}{U_{sig}} = -39 \cdot 0,323 = -12,6 \frac{\text{V}}{\text{V}} \end{array} \right.$$

Av $U_0 = 0,4V$ töre,

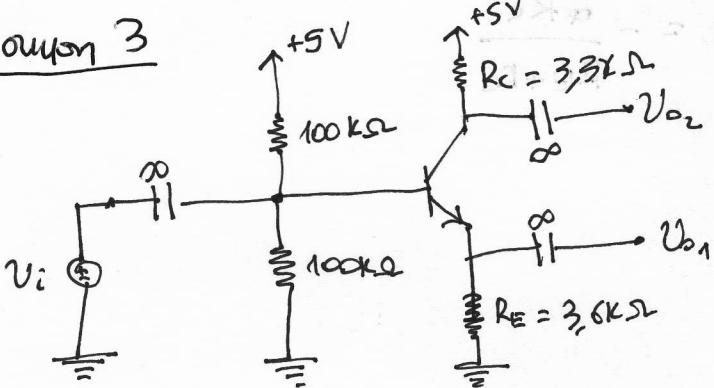
$$U_0 = 100 \cdot i_c = 100 \cdot g_m \cdot U_{IN} = 100 \cdot g_m \cdot i_b \cdot r_n = 100 \cdot g_m \cdot r_n \cdot \frac{10k}{10k+502,5} \cdot i_{sig} \Rightarrow$$

$$\Rightarrow U_0 = \frac{100 \cdot g_m \cdot r_n \cdot 10k}{10k+502,5} \cdot \frac{U_{sig}}{R_{sig} + 10k/502,5} \Rightarrow U_{sig} = \frac{(10 \cdot 502,5) \cdot (1,4785) \cdot 0,4V}{100 \Omega \cdot 502,5 \Omega \cdot 10k \Omega \cdot 0,398} \Rightarrow$$

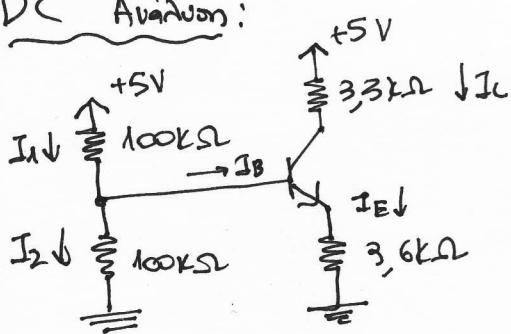
$$\Rightarrow U_{sig} \approx \pm 0,03V$$

$$U_b = U_{sig} - i_{sig} \cdot R_{sig} = U_{sig} - \frac{U_{sig}}{1478,45} R_{sig} = \pm 0,13V$$

Auflösung 3



DC Analyse:



$$\beta = \infty : I_C = I_E, I_B = 0$$

$$NPK: I_1 = I_2 = I = \frac{5}{200k} = 0,025mA$$

$$NTK: 5 - I \cdot 100k = V_B \Rightarrow V_B = 5 - 2,5 \Rightarrow V_B = 2,5V \\ (\text{Erwartet nahezu } V_{BE} = 0,7V)$$

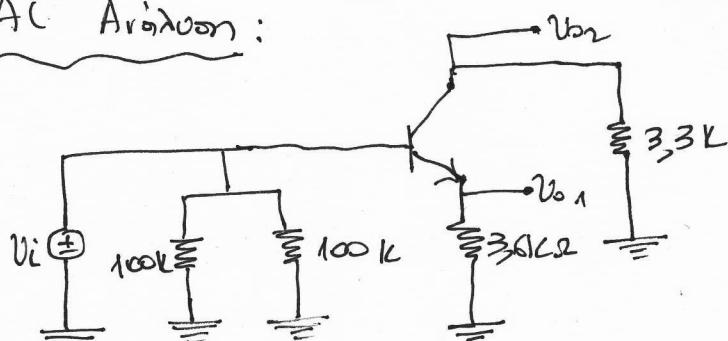
$$\text{Ara } V_E = 1,8V$$

$$NTIC: V_F - I_E \cdot 3,6k = 0 \Rightarrow I_E = \frac{1,2V}{3,6k\Omega} \Rightarrow I_F = 0,5mA = I_C$$

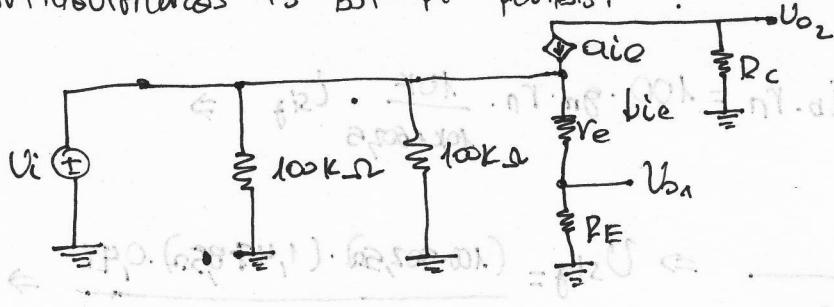
$$g_m = \frac{I_C}{V_T} = 9,02$$

$$r_e = \frac{V_T}{I_C} = 50$$

AC Analyse:



AVTILUDIMICROS TO BJT GE PUNKELOT:



$$i_e = \frac{V_i}{R_E + r_e}$$

$$U_{01} = i_e R_E = V_i \cdot \frac{R_E}{R_E + r_e}$$

$$U_{02} = -\alpha \cdot i_e R_c = -\frac{V_i}{R_E + r_e} \cdot R_c \Rightarrow \frac{U_{02}}{V_i} = -\frac{\alpha R_c}{R_E + r_e}$$

$\Gamma_1 = \alpha \approx 1 :$

$$r_e = \frac{V_T}{I_E} = \frac{25mV}{9.5mA} = 50\Omega$$

$$\frac{U_{01}}{V_i} = \frac{3,6}{3,6 + 0,5} = 0,786 \text{ V/V}$$

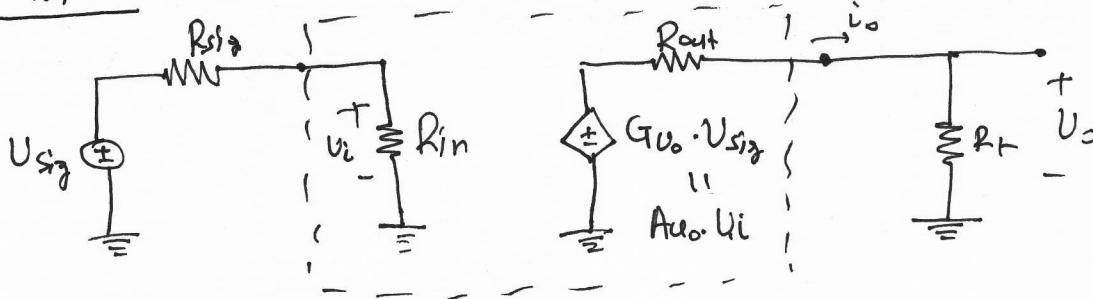
$$\frac{U_{02}}{V_i} = -\frac{3,3}{3,6 + 0,5} = 0,904 \text{ V/V}$$

$$\frac{U_{02}}{V_i} = -\frac{\alpha R_c}{r_e} = -\frac{3,3}{0,5} = -66 \text{ V}$$

$$500 \cdot \frac{3,6}{3,6 + 0,5} = 0,8$$

$$500 \cdot \frac{3,3}{3,6 + 0,5} = 0,7$$

Acción 4



$$G_{U_0} = \frac{U_o}{U_{sig}} \Big|_{R_L=\infty}, \quad G_{U_0} = \frac{R_{in}}{R_{in} + R_{sig}} \Big|_{R_L=\infty}, \quad A_{U_0} = \frac{U_o}{U_i} \Big|_{R_i=0}, \quad R_i = \frac{R_{in}}{R_L} = \infty$$

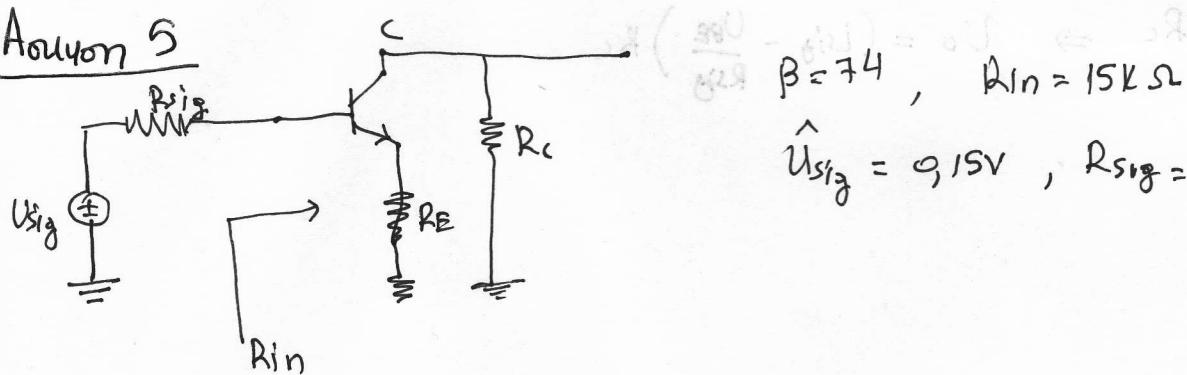
$$R_L = \infty, \quad G_{U_0} = \frac{R_i}{R_i + R_{sig}} \Big|_{A_{U_0}}, \quad G_{T_u} = G_{U_0} \frac{R_L}{R_L + R_{out}}$$

Si $R_L = \infty$, $G_{U_0} = \frac{U_o}{U_i} \cdot \frac{U_i}{U_{sig}} = A_{U_0} \cdot \frac{U_i}{U_{sig}} = A_{U_0} \cdot \frac{U_{sig} \cdot R_i}{U_{sig}}$

$$G_{U_0} = \frac{R_i}{R_i + R_{sig}} \cdot A_{U_0}$$

Si R_L ncfp., $G_{U_0} = \frac{U_o}{U_{sig}} = \underbrace{\frac{R_L}{R_L + R_{out}}}_{\text{fallo en ralas}} \cdot G_{U_0} \cdot U_{sig} \cdot \frac{1}{U_{sig}} \Rightarrow G_{U_0} = \frac{R_L}{R_L + R_{out}} \cdot G_{U_0}$

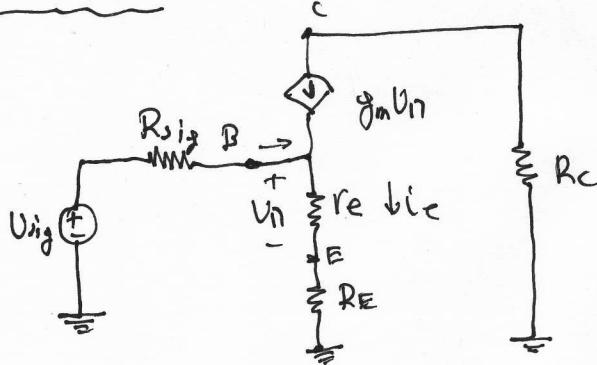
Acción 5



$$\beta = 74, \quad R_{in} = 15 k\Omega$$

$$\hat{U}_{sig} = 0.15V, \quad R_{sig} = 30 k\Omega \quad \hat{U}_{in} = 5mV$$

Movimiento T:



$$R_{in} = (\beta + 1)(r_e + R_E)$$

$$R_E + r_e = \frac{R_{in}}{\beta + 1}$$

$$U_{in} = \frac{r_e}{R_{sig} + R_E + r_e} U_{sig} \Rightarrow U_{in} (R_{sig} + R_E + r_e) = U_{sig} \cdot r_e$$

$$r_e = \frac{\beta}{\beta + 1} \cdot \frac{V_T}{I_C} \Rightarrow I_C = \frac{B V_T}{(\beta + 1) \cdot R_E}$$

Aoxygén 6 (7.79)

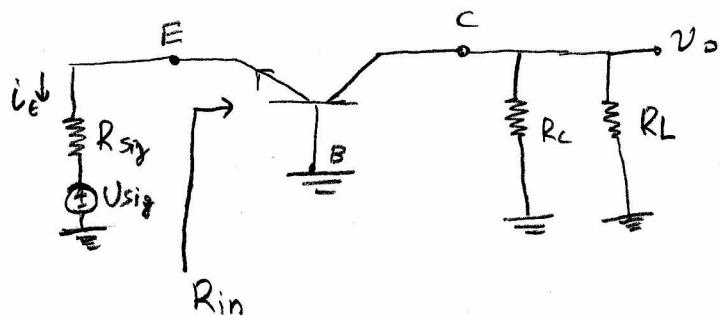
Evinoxutis CB

$$R_L = 10 \text{ k}\Omega$$

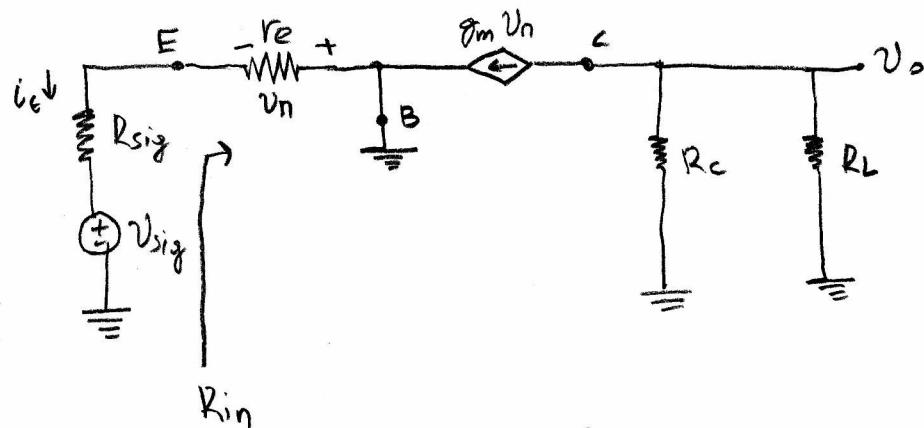
$$R_C = 10 \text{ k}\Omega$$

$$R_{sig} = 50 \Omega$$

$$\alpha \approx 1$$



Movimento T



$$R_{in} = \frac{U_{EB}}{i_e} = \frac{r_e \cdot i_e}{k_e} \Rightarrow R_{in} = r_e \Rightarrow r_e = 50 \Omega$$

$$r_e = \alpha \cdot \frac{V_T}{I_c} \Rightarrow I_c = \frac{\alpha \cdot V_T}{r_e} = \frac{1 - 25 \text{ mV}}{50 \Omega} = \frac{50 \cdot 10^{-3} \text{ V}}{2.5 \Omega} = 0.5 \text{ mA}$$

$$V_o = -i_c (R_C \parallel R_L) = (-0.5 \cdot 10^{-3} \text{ A}) \cdot (10 \text{ k}\Omega \parallel 10 \text{ k}\Omega) = (-0.5 \cdot 10^{-3} \text{ A}) \cdot (5 \cdot 10^3 \Omega) \Rightarrow$$

$$\Rightarrow V_o = -2.5 \text{ V}$$

$$\frac{V_o}{V_s} = (R_C \parallel R_L) \cdot \frac{1}{r_e + R_S} = \frac{5 \text{ k}\Omega}{50 \Omega + 50 \Omega} = \frac{5 \cdot 10^3 \Omega}{10^2 \Omega} = 50 \text{ V/V}$$

Aufgabe 7 (7.130)

a) $V_{CC} = 15 \text{ V}$, $R_1 = 100 \text{ k}\Omega$, $R_2 = 47 \text{ k}\Omega$, $R_E = 3,9 \text{ k}\Omega$, $R_C = 6,8 \text{ k}\Omega$, $\beta = 100$

DC Analysis für v_{bb} und v_{be} aus ≈ 80 mV :

$$V_{BB} = V_{CC} \cdot \frac{R_2}{R_1 + R_2} = 15 \cdot \frac{47}{100 + 47} = 4,8 \text{ V}$$

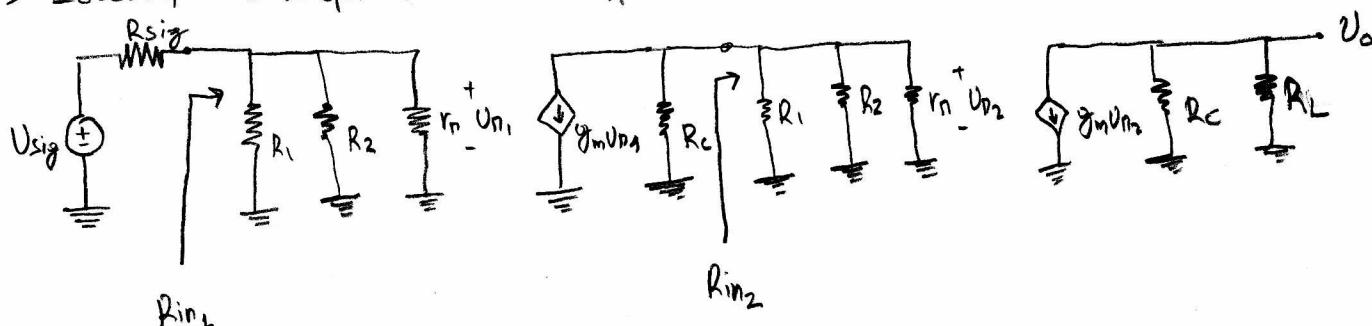
$$R_B = R_1 \parallel R_2 = 100 \parallel 47 = 32 \text{ k}\Omega$$

$$I_E = \frac{V_{BB} - V_{BE}}{R_E + \frac{R_B}{\beta + 1}} = \frac{4,8 - 0,7}{3,9 + \frac{32}{100+1}} = 0,97 \text{ mA} \approx 1 \text{ mA}$$

$$I_C = \alpha I_E \approx 1 \text{ mA}$$

$$V_C = V_{CC} - I_C R_C = 15 - 1 \cdot 6,8 = 8,2 \text{ V}$$

B) Isoverstärker Kennwerte Anstrengungen:



$$g_m = \frac{I_C}{V_T} = 40 \text{ mA/V} \quad , \quad r_n = \frac{\beta}{g_m} = 2,5 \text{ k}\Omega$$

f) $R_{sig} = 5 \text{ k}\Omega$:

$$R_{in1} = R_1 \parallel R_2 \parallel r_n = R_B \parallel r_n = 32 \parallel 2,5 = 2,32 \text{ k}\Omega$$

$$\frac{V_{b1}}{V_{sig}} = \frac{R_{in}}{R_{in} + R_{sig}} = \frac{2,32}{2,32 + 5} = 0,32 \text{ V/V}$$

g) $R_{in2} = R_1 \parallel R_2 \parallel r_n = R_{in1} = 2,32 \text{ k}\Omega$

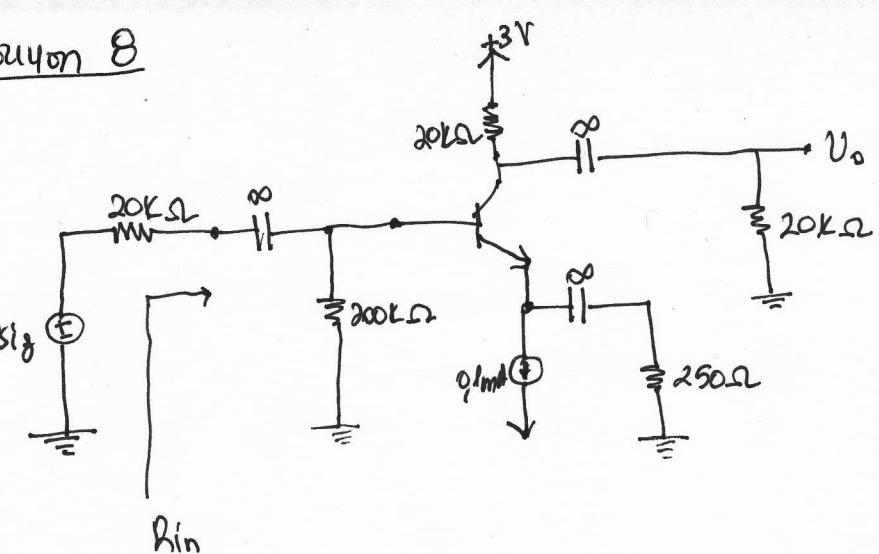
$$\frac{V_{b2}}{V_{b1}} = \frac{V_{b2}}{V_{in1}} = - g_m (R_C \parallel R_{in2}) = - 40 (6,8 \parallel 2,32) = - 69,2 \text{ V/V}$$

h) $R_L = 2 \text{ k}\Omega$:

$$\frac{V_o}{V_{b2}} = \frac{V_o}{V_{in2}} = - g_m (R_C \parallel R_L) = - 40 (6,8 \parallel 2) = - 61,8 \text{ V/V}$$

$$v_2 = \frac{V_o}{V_{sig}} = \frac{V_o}{V_{b2}} \cdot \frac{V_{b2}}{V_{b1}} \cdot \frac{V_{b1}}{V_{sig}} = (- 61,8) \cdot (- 69,2) \cdot 0,32 = 1.368,5 \text{ V/V}$$

Aufgabe 8



$$I_E = 0,1 \text{ mA}$$

$$r_e = \frac{V_T}{I_E} = \frac{25 \text{ mV}}{0,1 \text{ mA}} = 250 \Omega$$

$$g_m = \frac{I_C}{V_T} \approx \frac{0,1 \text{ mA}}{0,025 \text{ V}} = 4 \text{ mA/V}$$

$$R_E = 250 \Omega$$

$$R_{in} = 200 \Omega \parallel (\beta + 1)(r_e + R_E) = 200 \parallel [101 \times (0,25 + 0,25)] = 200 \parallel 50,5 = 40,3 \text{ k}\Omega$$

$$\frac{V_b}{U_{sig}} = \frac{R_{in}}{R_{in} + R_{sig}} = \frac{40,3}{40,3 + 20} = 0,668 \text{ V/V}$$

$$\frac{V_o}{V_b} = -\beta \frac{R_E}{r_e + R_E} \approx -\frac{20 \parallel 20}{0,25 + 0,25} = -20 \text{ V/V}$$

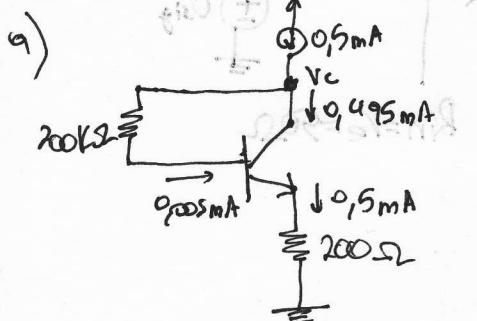
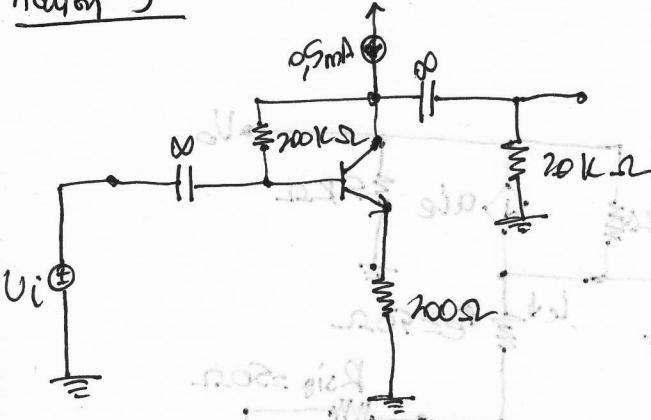
$$G_{rv} = \frac{V_o}{U_{sig}} = \frac{V_o}{V_b} \cdot \frac{V_b}{U_{sig}} = -0,668 \times 20 = -13,4 \text{ V/V}$$

Für V_{be} resultiert aus 5 mV , es mit ΔV_{be} nimmt man einen Wert von 10 mV .

$$\hat{V}_{sig} = \frac{10 \text{ mV}}{\frac{V_b}{U_{sig}}} = \frac{10 \text{ mV}}{0,668 \text{ V/V}} = 15 \text{ mV}$$

$$\text{Daher, } V_o = |G_{rv}| \cdot \hat{V}_{sig} = 13,4 \times 15 = 200 \text{ mV} = 0,2 \text{ V}$$

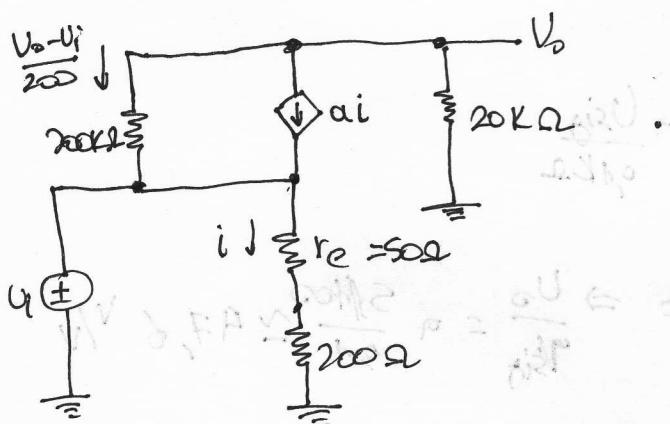
Aufgabe 9



$$I_C = 0,495 \text{ mA}$$

$$\begin{aligned} V_C &= I_B \times 200\text{k}\Omega + I_E \times 0,2\text{k}\Omega + V_{BE} \\ &= 0,005 \times 200 + 0,5 \times 0,2 + 0,7 \\ &= 1,18 \text{ V} \end{aligned}$$

b)



$$g_m = \frac{I_C}{V_T} = \frac{0,495}{0,025} \approx 20 \text{ mA/V}$$

$$r_e = \frac{V_T}{I_E} = 50 \Omega$$

$$i = \frac{V_i}{r_{e+R_L}} = \frac{V_i}{50 + 200} = \frac{V_i}{250} = 4V_i \text{ (mA)}$$

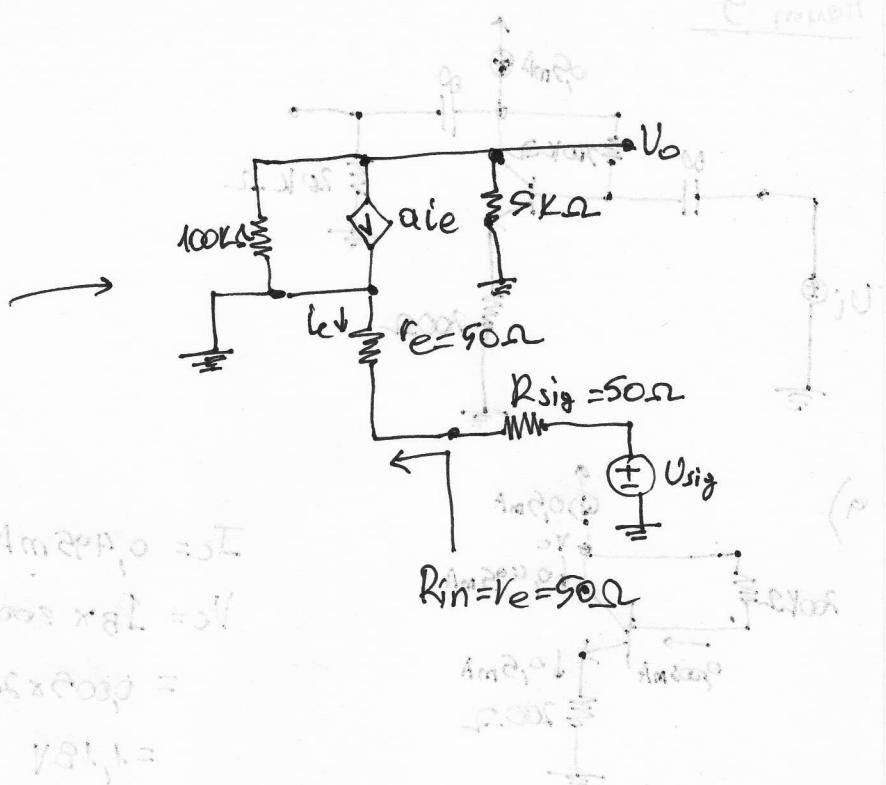
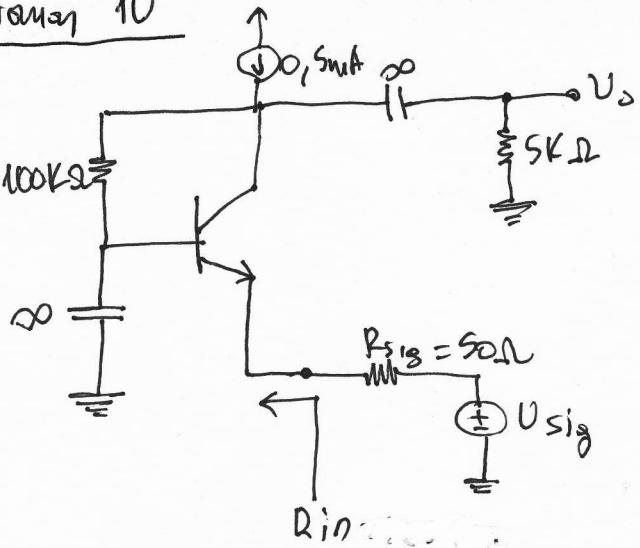
$$\frac{U_o}{20} + ai + \frac{U_o - U_C}{200} = 0 \Rightarrow$$

$$\Rightarrow \frac{U_o}{20} + 0,99 \times 4V_i + \frac{U_o}{200} - \frac{U_i}{200} = 0$$

$$\Rightarrow U_o \left(\frac{1}{20} + \frac{1}{200} \right) = -U_i \left(4 \cdot 0,99 - \frac{1}{200} \right)$$

$$\Rightarrow \frac{U_o}{U_i} = -7,9 \text{ V/mm}$$

Aufgabe 10



$$I_C = a I_E \approx 95 \text{ mA}$$

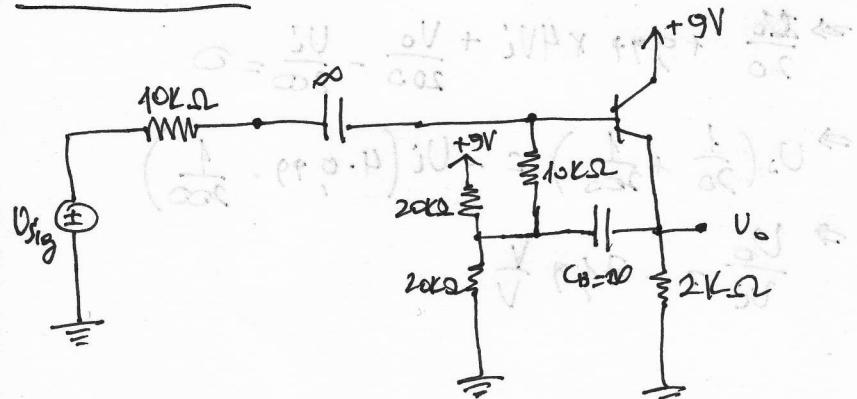
$$r_e = \frac{V_T}{I_E} = \frac{25 \text{ mV}}{95 \text{ mA}} = 50 \Omega$$

$$R_{\text{in}} = r_e = 50 \Omega$$

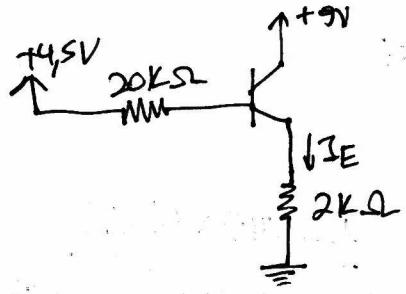
$$i_e = -\frac{U_{\text{Sig}}}{r_e + R_{\text{sig}}} = -\frac{U_{\text{Sig}}}{50 + 50} = -\frac{U_{\text{Sig}}}{100} = -\frac{U_{\text{Sig}}}{0,1 \text{ k}\Omega}$$

$$U_O = -a \cdot i_e (5 / 100) = a \frac{U_{\text{Sig}}}{100} \cdot (5 / 100) \Rightarrow \frac{U_O}{U_{\text{Sig}}} = a \frac{5 / 100}{0,1} \approx 47,6 \text{ V/V}$$

Aufgabe 11



DC 1005. (p + Thevenin):



$$a) I_E = \frac{4.5 - 0.7}{2 + \frac{20}{\beta+1}} = \frac{3.8}{2 + \frac{20}{101}} = 1.73 \text{ mA}$$

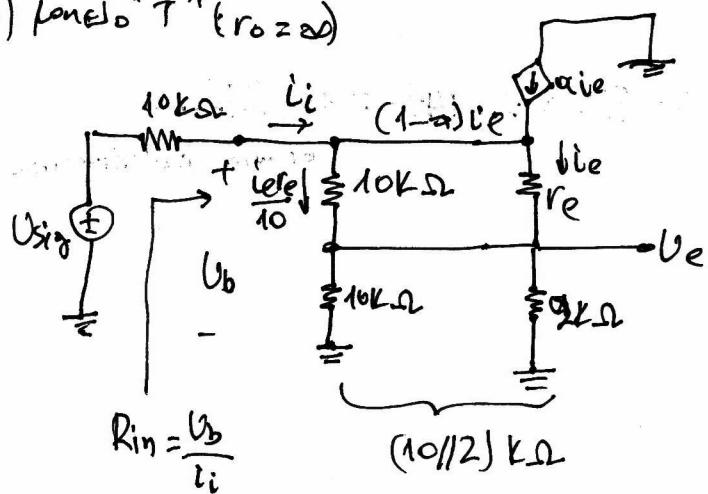
$$I_C = \alpha I_E = 0.99 \times 1.73 \text{ mA} = 1.71 \text{ mA}$$

$$g_m = \frac{I_C}{V_T} = 68.4 \text{ nA/V}$$

$$r_e = \frac{V_T}{I_E} = \frac{25 \text{ mV}}{1.73 \text{ mA}} = 14.5 \Omega = 0.0145 \text{ k}\Omega$$

$$r_h = (\beta + 1)r_e = 101 \times 0.0145 = 1.4645 \text{ k}\Omega$$

b) Longo "T" ($r_o = \infty$)



$$V_e = (i_c + i_c \frac{r_e}{10}) (10/2)$$

$$V_b = V_c + i_c r_e = i_c (10/2) \cdot (1 + \frac{r_e}{10}) + i_c r_e$$

$$i_i = (1 - a) i_c + i_c \frac{r_e}{10} = \frac{i_c}{\beta+1} + i_c \frac{r_e}{10}$$

$$\begin{aligned} R_{in} &= \frac{V_b}{i_i} = \frac{(10/2) \cdot (1 + \frac{r_e}{10}) + r_e}{\frac{1}{\beta+1} + \frac{r_e}{10}} = \frac{(\beta+1)(10/2)(1 + \frac{r_e}{10}) + (\beta+1)r_e}{(\beta+1)\frac{r_e}{10} + 1} = \\ &= \frac{101 \times (10/2) \times (1 + 0.00145) + 101 \times 0.0145}{1 + 101 \times 0.00145} = 148.3 \text{ k}\Omega \end{aligned}$$

$$\frac{U_b}{U_{sig}} = \frac{R_{in}}{R_{in} + R_{sig}} = \frac{48,3}{148,3 + 10} = 0,937$$

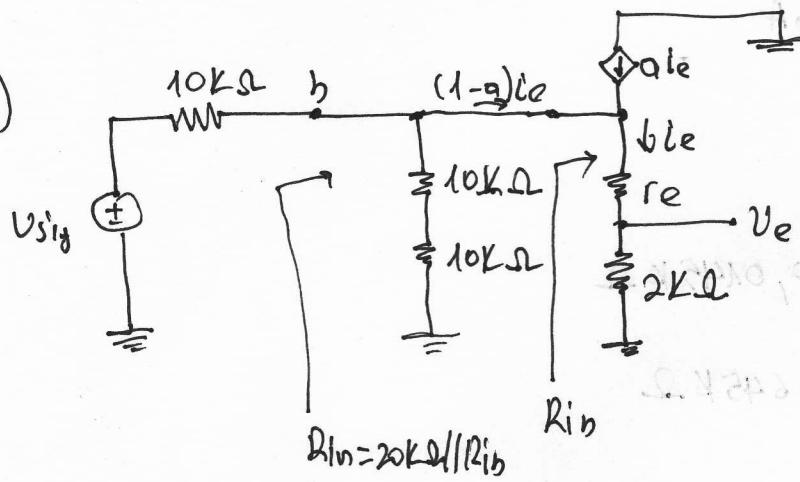


: (10000/(1+1)) * 0,937 = 0,937

$$\frac{U_o}{U_b} = \frac{U_o}{U_b} = \frac{i_e \left(1 + \frac{r_e}{10}\right) (10/12)}{i_e \left(1 + \frac{r_e}{10}\right) (10/12) + i_e r_e} = \frac{1,00145 \times (10/12)}{1,00145 \times (10/12) + 0,0145} = 0,991 \text{ V/V}$$

$$G_{TV} = \frac{U_o}{U_{sig}} = 0,937 \times 0,991 = 0,93 \text{ V/V}$$

j)



$$R_{in} = 20\text{k}\Omega // R_{ib}$$

$$R_{in} = 20\text{k}\Omega // R_{ib} = 20\text{k}\Omega // (\beta + 1)(R_E + 2) = 20 // 101 \times 2,0145 = 18,21\text{k}\Omega$$

$$\frac{U_b}{U_{sig}} = \frac{R_{in}}{R_{in} + R_{sig}} = \frac{18,21}{28,21} = 0,646 \text{ V/V}$$

$$\frac{U_o}{U_b} = \frac{2}{2 + 0,0145} = 0,993$$

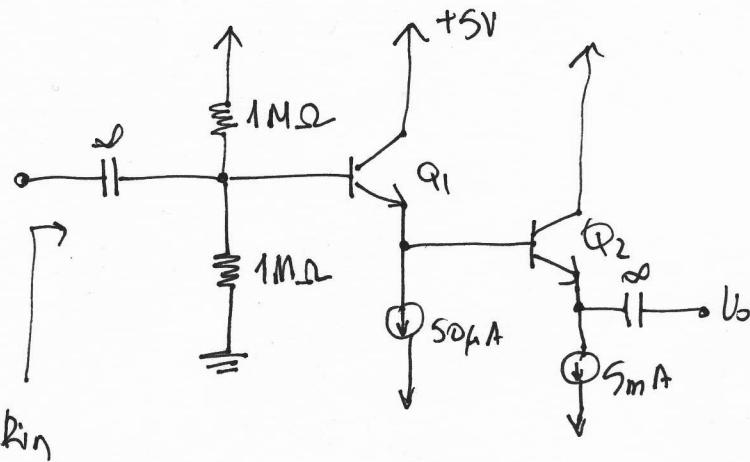
$$G_{TV} = \frac{U_o}{U_{sig}} = 0,646 \times 0,993 = 0,64 \text{ V/V}$$

$$= \frac{\beta(\beta+1) + (\frac{2}{\beta+1} + 1)(\beta + 1)(\beta + 2)}{\beta + \frac{2}{\beta+1}(\beta+1)}$$

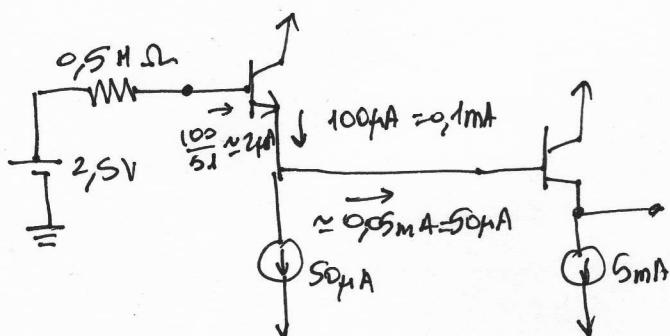
$$= \frac{\beta + (\frac{2}{\beta+1} + 1)(\beta + 1)}{\beta + \frac{2}{\beta+1}}$$

$$= \frac{2 + (\beta + 1)^2 + (\beta + 1) \times (\beta + 2)}{\beta + 2 + \beta + 1} =$$

Aufgabe 12



a) DC (if Thevenin):



$$I_{E1} = 0,1 \text{ mA}$$

$$I_{E2} = 5 \text{ mA}$$

$$V_{B1} = 2,5 - 24 \times 0,5 \text{ M}\Omega = 1,5 \text{ V}$$

$$V_{B2} = V_{B1} - 97 = 98 \text{ V}$$

b) $R_L = 1 \text{ k}\Omega$

$$\frac{U_o}{U_{B2}} = \frac{R_L}{R_L + r_{e2}}$$

$$r_{e2} = \frac{25 \text{ mV}}{5 \text{ mA}} = 5 \text{ }\Omega$$

$$\frac{U_o}{U_{B2}} = \frac{1000}{1000 + 5} = 0,995 \text{ V/V}$$

$$R_{iB2} = (\beta_2 + 1)(r_{e2} + R_L) = 101 \times 1,005 = 101,5 \text{ k}\Omega$$

c) $R_{in} = 1 \text{ M}\Omega // 1 \text{ M}\Omega // (\beta + 1)(r_{e1} + R_{iB2})$

$$r_{e1} = \frac{V_T}{I_{E1}} = \frac{25 \text{ mV}}{0,1 \text{ mA}} = 250 \text{ }\Omega = 0,25 \text{ k}\Omega$$

$$R_{in} = 0,5 \text{ M}\Omega // [51 \times (0,25 + 101,5)] \text{ k}\Omega = 0,5 \text{ M}\Omega // 5,2 \text{ M}\Omega = 456 \text{ k}\Omega$$

$$\frac{U_{re1}}{U_{B1}} = \frac{R_{iB}}{R_{iB} + r_{e1}} = \frac{101,5}{101,5 + 0,25} = 0,9975 \text{ V/V}$$

$$\delta) \frac{U_{B1}}{U_{sig}} = \frac{R_{in}}{R_{in} + 250} = \frac{456}{456 + 100} = 0,82 \text{ V/V}, \quad \epsilon) \frac{U_o}{U_{sig}} = 0,82 \times 0,9975 \times 0,995 = 0,814 \text{ V} \quad 13$$

Άσκηση 13

E) DC ANALYSIS

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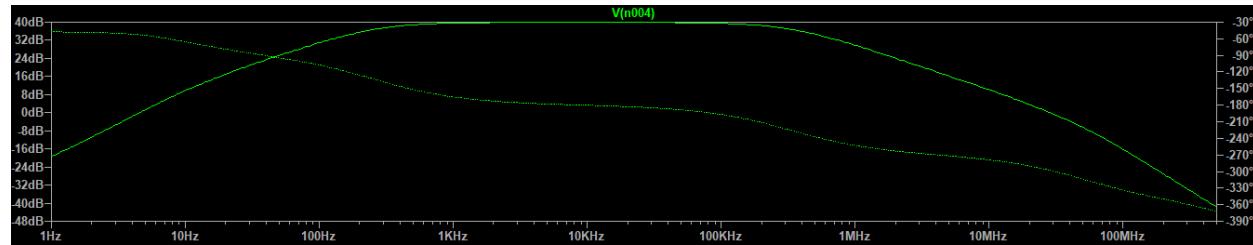
--- Operating Point ---

```

V(b1) : 2.95715 voltage
V(e1) : 2.30299 voltage
V(n003) : 4.46429 voltage
V(n002) : 12 voltage
V(n001) : 12 voltage
V(c1) : 7.93588 voltage
V(c2) : 12 voltage
V(e2) : 7.24457 voltage
V(n004) : 1.44891e-013 voltage
V(vo) : 0 voltage
V(n005) : 5.9143e-014 voltage
Ic(Q1) : 0.000996539 device_current
Ib(Q1) : 4.76135e-006 device_current
Ie(Q1) : -0.0010013 device_current
Ic(Q2) : 0.00400527 device_current
Ib(Q2) : 1.94913e-005 device_current
Ie(Q2) : -0.00402476 device_current
I(C2) : 5.9143e-017 device_current
I(C4) : -1.44891e-016 device_current
I(C3) : 4.60598e-017 device_current
I(C1) : 8.92858e-017 device_current
I(R2) : 5.9143e-017 device_current
I(R1) : 1.44891e-016 device_current
I(Re2) : 0.00402476 device_current
I(Rc) : 0.00101603 device_current
I(Rb1) : 0.00025119 device_current
I(Rb2) : -0.00025119 device_current
I(R3) : -0.0010013 device_current

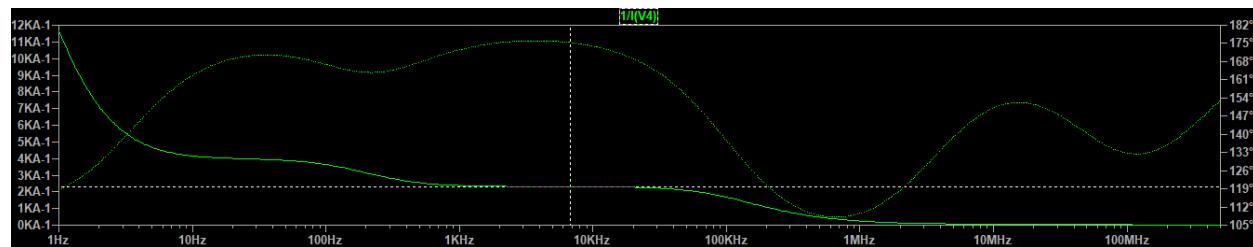
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ΣT) diagrama bode

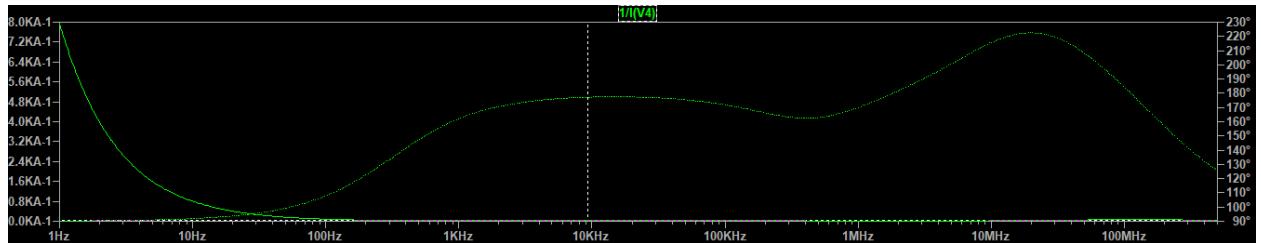


Z)

2.3K Ω



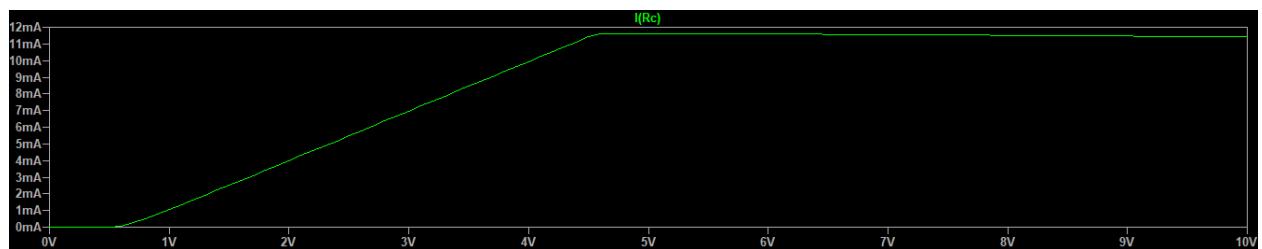
H)



Rout peripou 25Ω

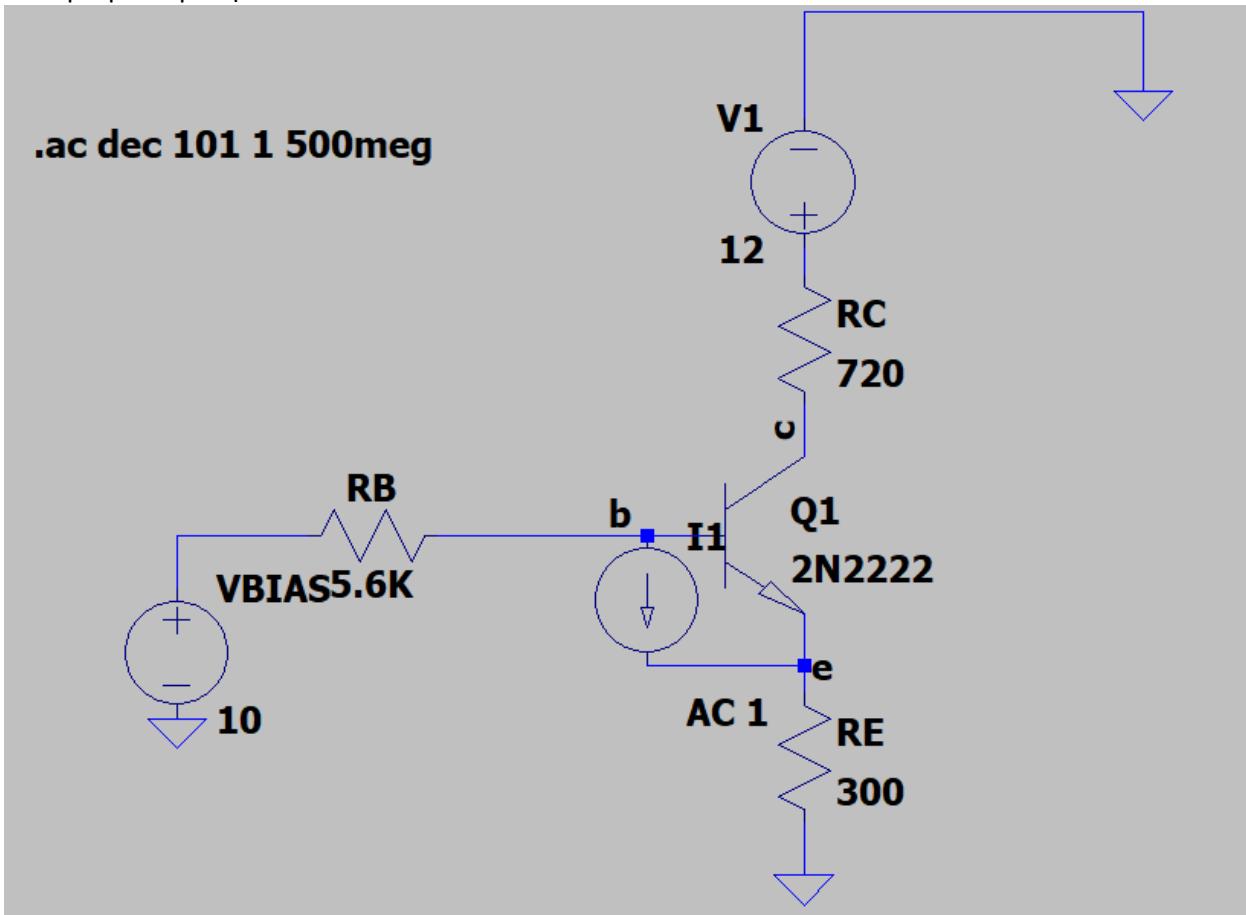
Άσκηση 14

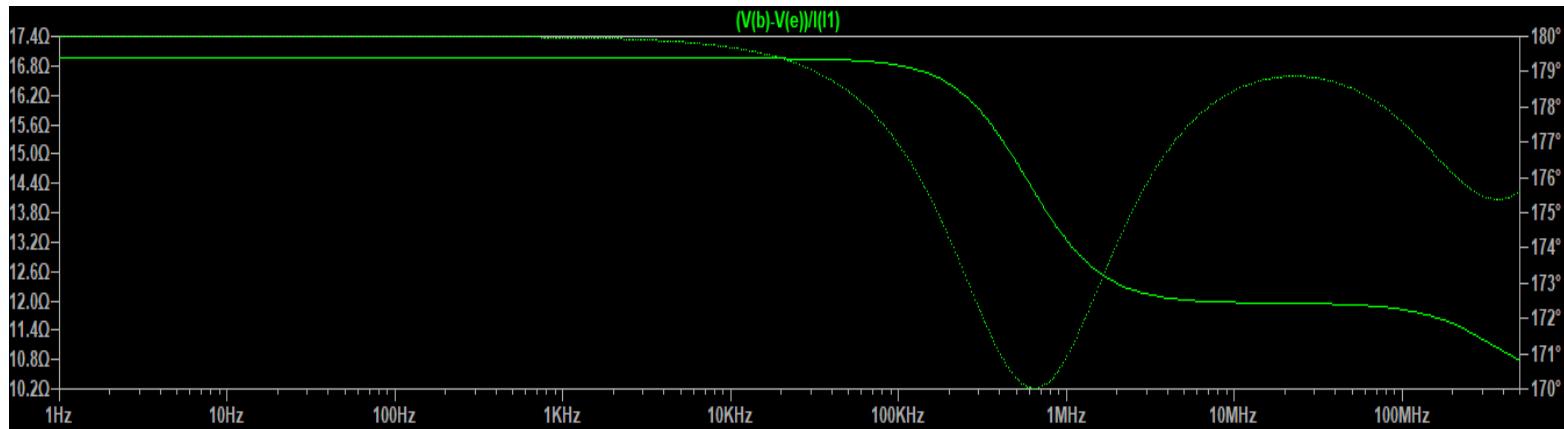
A)



B)

Κύκλωμα για έυρεση RBE





Γ)

