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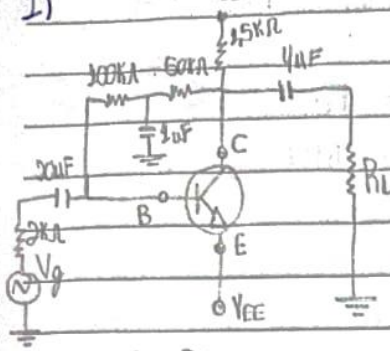
$V_{BE} = 0,6V$

1) $R_L = 2K\Omega$ $V_{CC} = 15V$ $V_{EE} = 5V$ $\beta = 120$ $R_o = 42K\Omega$

$C_{\mu i} = 5pF$ $C_{BE} = 15pF$ $C_{CE} = 2pF$

$C_{\mu o} = 7pF$ $C_{BC} = 3pF$



1º Análise em CC

$-V_{CC} + 1,5K i_E + (50K + 100K) i_B + V_{BE} + V_{EE} = 0$

$1,5K(\beta+1) i_B + 150K i_B = V_{CC} - V_{BE} - V_{EE}$

$i_B = 22,356\mu A$

$i_C = \beta i_B$

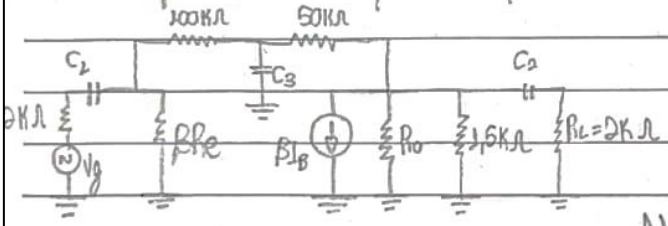
$i_E = i_B(\beta+1)$

$i_C = 3,403mA$

$i_E = 3,431mA$

$R_E = \frac{26m}{I_E} = 7,578\Omega$

2º Circuito Equivalente e Frequência Inferior

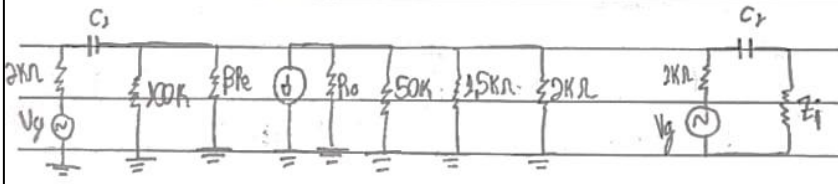


$Z_i = 100K \,||\, \beta re = 901,165\Omega$

$Z_o = (R_o || 50K) || 1,5K = 1,408K\Omega$

$\Delta V = \frac{V_o}{V_i} = -\frac{\beta I_B (Z_o || 2K\Omega)}{\beta re \cdot I_B} = -109,038$

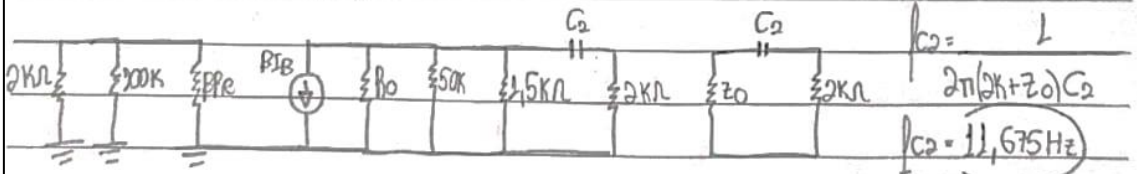
F_{C1} (C_2 e C_3 em curto)



$f_{C1} = \frac{1}{2\pi(2K + Z_i) C_1}$

$f_{C1} = 2,743Hz$

F_{C2} (C_1 e C_3 em curto)

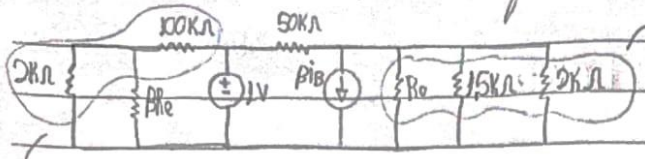


$f_{C2} = \frac{1}{2\pi(2K + Z_o) C_2}$

$f_{C2} = 11,675Hz$

f_{Ci}

F_{C3} (C_1 e C_2 em curto) e colocando carga teste em C_3

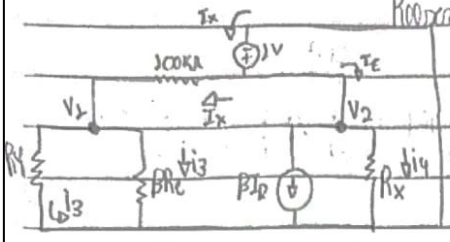


$R_X = R_o \| 1,5K \| 2K$

$R_X = 840\Omega$

$R_Y = 2K \| 100K = 1,961K\Omega$

Reorganizando



Nó 1: $I_B = I_3 - I_1 = 0$

$$\frac{V_1}{\beta R_e} + \frac{V_1}{R_1} - \frac{1-V_1}{100K} = 0 \rightarrow V_1\left(\frac{1}{\beta R_e} + \frac{1}{R_1} + \frac{1}{100K}\right) = \frac{1}{100K}$$

$V_1 = 6,174mV$

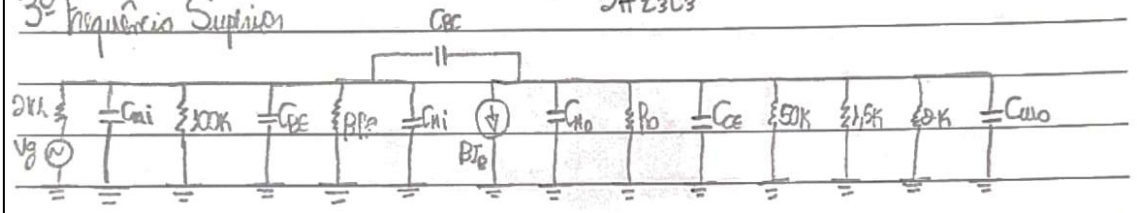
Nó 2: $\beta I_B + I_4 - I_2 = 0 \rightarrow \frac{\beta V_1}{\beta R_e} + \frac{V_2}{R_X} - \frac{1-V_2}{50K} = 0 \rightarrow V_2\left(\frac{1}{R_X} + \frac{1}{50K}\right) \therefore V_2 = -0,657V$

$I_X = I_1 + I_2 \rightarrow I_X = \frac{1-V_1}{100K} + \frac{1-V_2}{50K} = 43,078\mu A$

$Z_3 = \frac{1V}{I_X} = 23,214K\Omega$

$f_{C3} = \frac{1}{2\pi Z_3 C_3} = 6,856Hz$

3º Frequência Superior



$C_{Mi} = (1-\Delta V) C_{BC} = 330,114pF$

$C_i = C_{Mi} + C_{BE} + C_{mi} = 350,114pF$

$C_{Mo} = \left(1 - \frac{1}{\Delta V}\right) C_{BC} = 3,028pF$

$C_o = C_{Mo} + C_{CE} + C_{wo} = 19,028pF$

Em C_i: $R_{Ci} = Z_i \| 2K = 621,249\Omega$

$f_{Ci} = \frac{1}{2\pi . R_{Ci} . C_i} = 731,726kHz$ → FCS

Em C_o: $R_{Co} = Z_o \| 2K = 826,291\Omega$

$f_{Co} = \frac{1}{2\pi . R_{Co} . C_o} = 16,014MHz$

Frequência de Corte Inferior = 11,675Hz

Frequência de Corte Superior = 731,726KHz