Segunda Avaliação (P2) - Eletrônica B

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1) Considere o circuito da Fig. 1. Considere RL = 1 KΩ. Determine:

a) Frequência de inferior do circuito;

b) Frequência de corte superior do circuito, com:

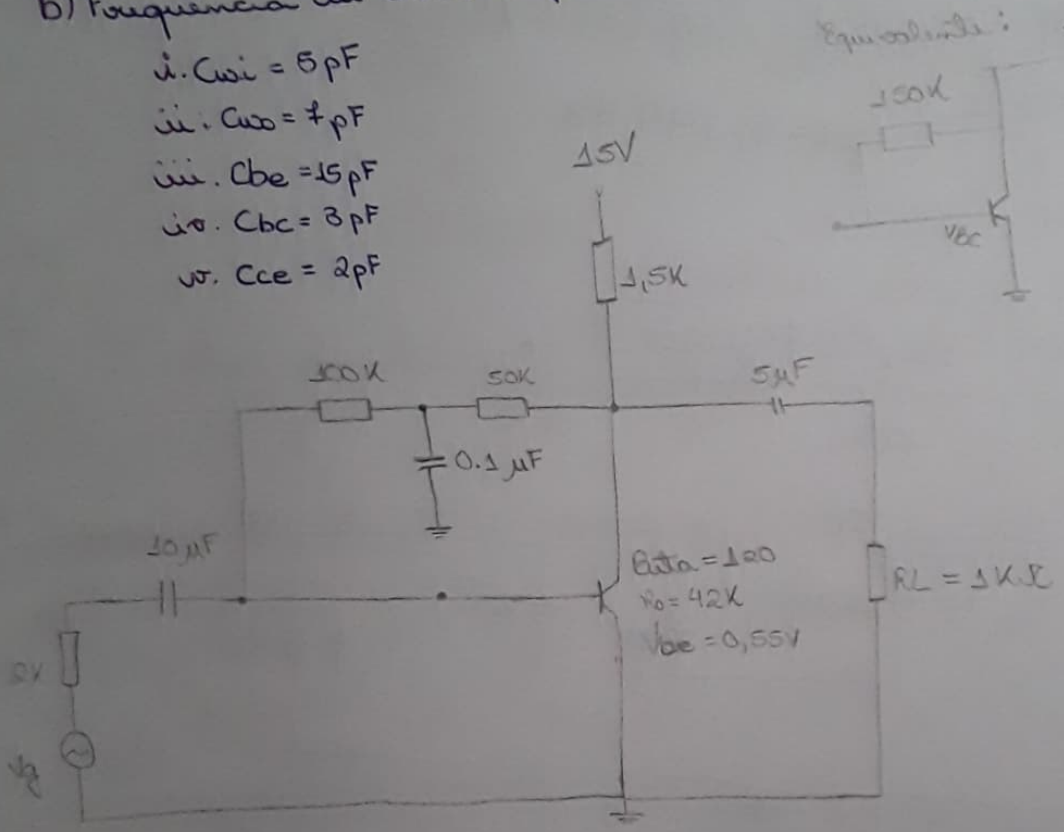
i. Cwi = 5 pF

ii. Cwo = 7 pF

iii. Cbe = 15 pF

iv. Cbc = 3 pF

v. Cce = 2 pF

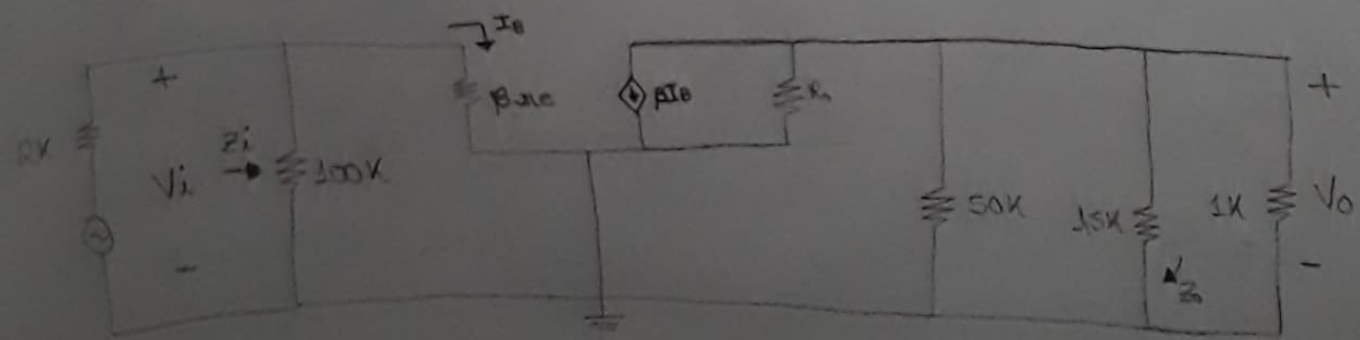


Analisar CC:

$15 - 1{,}5K \cdot I_E - 50K \cdot I_B - 100K \cdot I_B - V_{BE}$

$I_B = 43{,}589\ \mu A \qquad I_C = 5{,}230\ mA \qquad I_E = 5{,}274\ mA$

$re = \frac{26\ mV}{I_E} \rightarrow re = \frac{26\ mV}{5{,}274} = 4{,}929\ \Omega$



$z_i = \frac{100K \cdot \beta re}{100 + \beta re}$

$z_i = 588{,}002\ \Omega$

$Z_o = R_o // 50K // 1{,}5K$

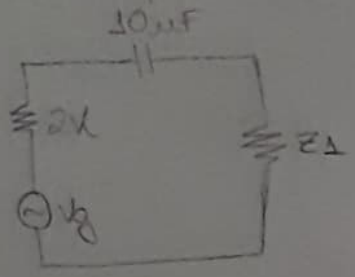
$Z_o = 1{,}407\ K\Omega$

$\Delta V = \frac{-\beta I_B (R_o // 1K)}{I_B \cdot \beta re}$

$\Delta V = -118{,}593$

* Frequência de corte inferior: (para C1, C2 e C3)

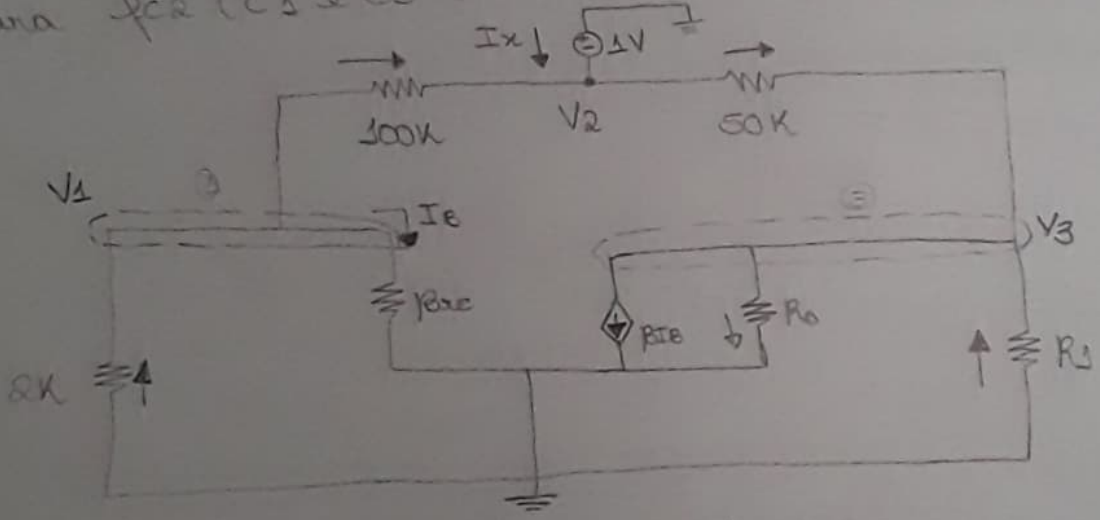
Para f_{c1} (C2 e C3 curto)



$$f_{c1} = \frac{1}{2\pi \cdot (Z_i + 2K)(10\mu)}$$

$f_{c1} = 6,149\ Hz$

Para f_{c2} (C1 e C3 curto)



$R_1 = 1,5 // 1K$ $\quad I_B = \frac{V_1}{\beta re}$ $\quad V_2 = 1V$

nó V1:

$$\frac{-V_1}{2K} = \frac{V_1 - V_2}{100K} + I_B$$

$$\frac{V_1 - V_2}{100K} + \frac{V_1}{\beta re} + \frac{V_1}{2K} = 0$$

$V_1 = 1,544\ mV$

nó V3:

$$\frac{V_2 - V_3}{50K} - \frac{V_3}{R_1} = \frac{V_3}{R_o} + \beta\left(\frac{V_1}{\beta re}\right)$$

$$\frac{V_3}{R_o} + \frac{V_1}{re} + \frac{V_3}{R_1} + \frac{V_3 - V_2}{50K} = 0$$

$V_3 = -0,527V$

Nó V2:

$$\frac{V_1 - V_2}{100K} + I_x = \frac{V_2 - V_3}{50K}$$

$$I_x + \frac{V_1 - V_2}{100K} + \frac{V_3 - V_2}{50K} = 0$$

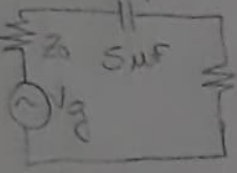
$I_x = 40,494\ \mu A$

$$Z_2 = \frac{1V}{I_x}$$

$Z_2 = 24,695\ K\Omega$

$$f_{c2} = \frac{1}{2\pi(z_2)(0,1\mu)} = 64,448\ Hz$$

Para f_{c3} (C_1 e C_2 curto)



$$f_{c3} = \frac{1}{2\pi(z_0 + 1K)(5\mu)} = 13,224\ Hz$$

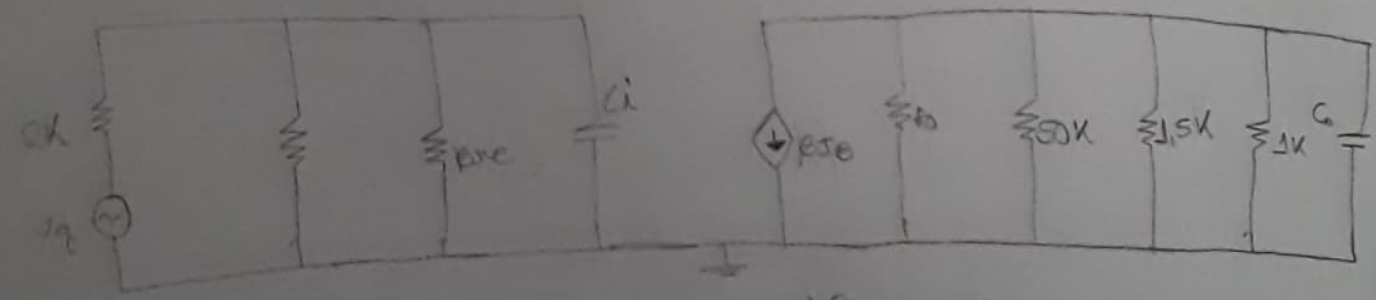
* Frequência de corte superior:

$C_{mi} = (1 - \Delta V) \cdot C_{BC} \Rightarrow C_{mi} = 358,779\ pF$

$C_{mo} = (\Delta - 1/\Delta V) \cdot C_{BC} \Rightarrow C_{mo} = 3,025\ pF$

$C_i = C_{wi} + C_{BE} + C_{mi} \rightarrow C_i = 378,779\ pF$

$C_o = C_{wo} + C_{cc} + C_{mo} \rightarrow C_o = 12,025\ pF$



Impedância C_i

$R_i = 2K \,//\, 100K \,//\, \beta re$

f_c entrada:

$$f_{ci} = \frac{1}{2\pi \cdot R_i \cdot C_i} = 924,676\ KHz$$

Impedância C_o

$R_o = R_o \,//\, 50K \,//\, 1,5K \,//\, 1K$

f_c entrada:

$$f_{co} = \frac{1}{2\pi \cdot R_o \cdot C_o} = 22,642\ MHz$$

Logo:

Frequência de corte inferior: 64,448 Hz

Frequência de corte superior: 924,676 KHz