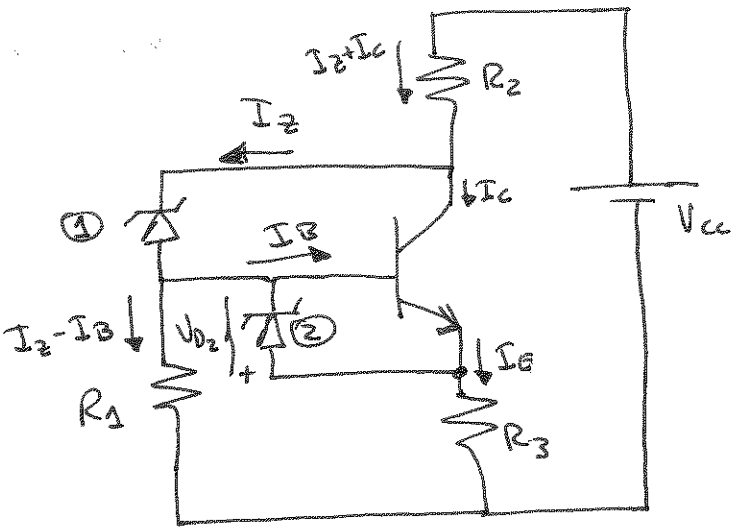
Solución ejercicio refuerzo Bipolar:

a) Circuito en DC



Supongo activa para BJT:

$i_C = \beta i_B \quad i_E = (\beta+1) i_B$

$U_{BE} = 0'7V$

$\hookrightarrow U_{D_2} = -0'7V \Rightarrow \begin{cases} < V_\gamma = 0'8V \\ > -|V_z| = -3'6V \end{cases}$

$\Rightarrow D_2$ en corte

Supongo D_1 en zener

$\Rightarrow U_{CB} = 3'6V = V_z$

$\Rightarrow U_{CE} = U_{CB} + U_{BE} = 4'3V > 0'2V$ OK ACTIVA

MALLA B-E:

$$V_{cc} = (I_z + I_C) R_2 + V_z + U_{BE} + I_E R_3$$

EXT:

$$V_{cc} = (I_z + I_C) R_2 + V_z + (I_z - I_B) R_1$$

$$(I_z - I_B) R_1 = U_{BE} + I_E R_3 \hookrightarrow I_z = \frac{U_{BE} + I_E R_3 + I_B R_1}{R_1}$$

$$V_{cc} = \left(\frac{U_{BE} + I_E R_3 + I_B R_1}{R_1} + I_C \right) R_2 + V_z + U_{BE} + I_E R_3$$

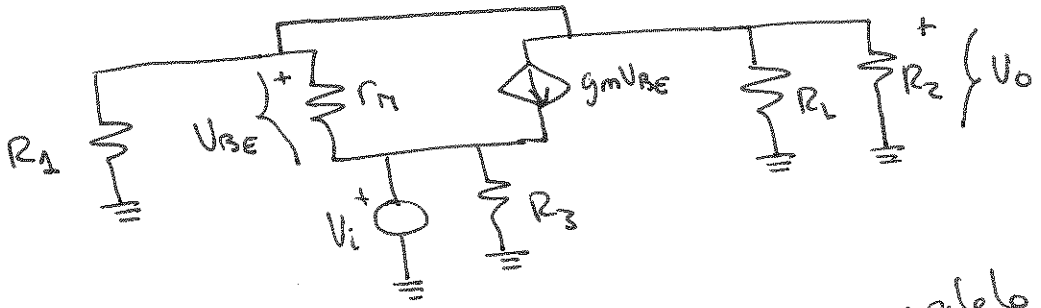
$$V_{cc} - V_z - U_{BE} - \frac{R_2}{R_1} U_{BE} = \frac{R_2 R_3}{R_1} (\beta+1) I_B + I_B R_2 + \beta I_B R_2 + (\beta+1) I_B R_3$$

$\frac{R_2}{R_1} U_{BE}$ $\quad 27'67 \mu A$

b) $I_z = \frac{U_{BE} + \dots}{R_1} = 8\ I_{max}$ $\quad < I_{z,max} = \frac{P_{max}}{V_z} = 2+8 mA$

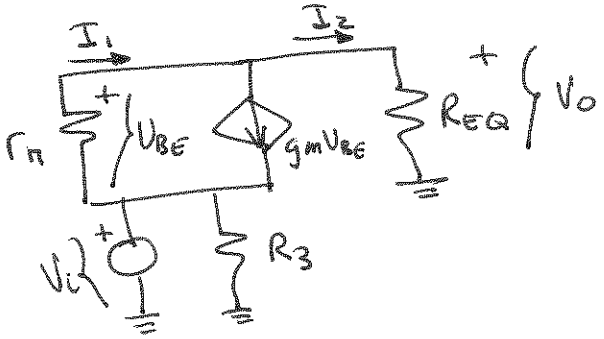
c) D1: ZENER $\equiv$ $\frac{1}{T}$ V_Z → en ac

D2: CORTE $\equiv$ → en ac



R_1, R_2 y R_L en paralelo $\equiv R_{EQ} = 340'9\,\Omega$

d) $V_o = V_{BE} + V_i$



$I_1 = g_m V_{BE} + I_2$

$$\frac{V_i - V_o}{r_\pi} = g_m (V_o - V_i) + \frac{V_o}{R_{EQ}}$$

$$\frac{V_i}{r_\pi} + g_m V_i = \frac{V_o}{r_\pi} + g_m V_o + \frac{V_o}{R_{EQ}}$$

$$g_m = \frac{I_C}{V_T} = 214'34\ m\frac{A}{V}$$

$$r_\pi = \frac{\beta}{g_m} = 933'09\,\Omega$$

$$\frac{V_o}{V_i} = \frac{\frac{1}{r_\pi} + g_m}{\frac{1}{r_\pi} + g_m + \frac{1}{R_{EQ}}} = 0'9865$$