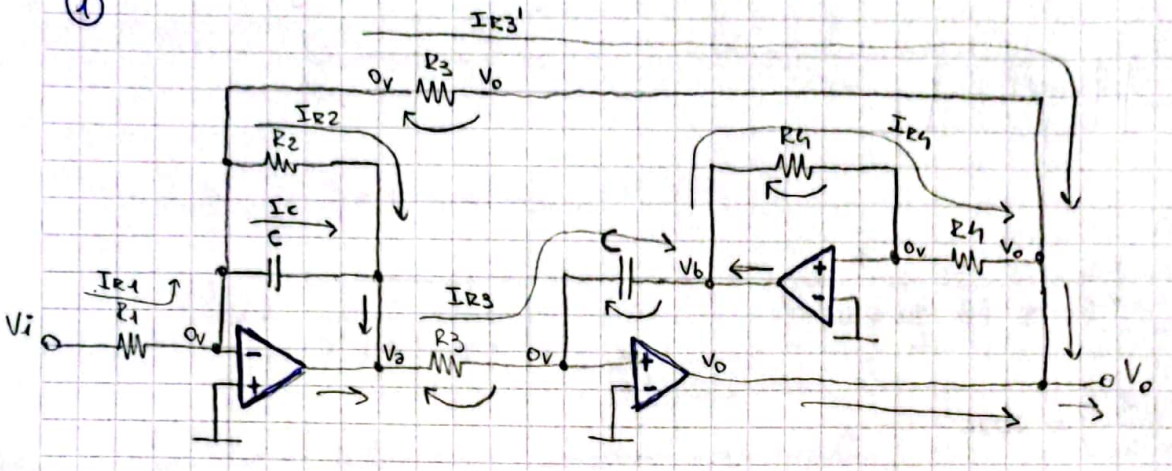
HOJA N°

FECHA

TRABAJO SEMANAL N° 2

①



$$I_{R4} = \frac{0_V - V_o}{R_4} = -\frac{V_o}{R_4} \qquad V_b = 0_V + V_{R4} = I_{R4} \cdot R_4 = -V_o$$

$$\boxed{V_b = -V_o}$$

$$I_{R3} = \frac{0_V - V_b}{\frac{1}{\$C}} = V_o \cdot \$C \qquad V_a = 0_V + V_{R3} = I_{R3} \cdot R_3 = V_o \$C R_3$$

$$\boxed{V_a = V_o \cdot \$R_3 C}$$

$$I_{R1} = I_{R2} + I_C + I_{R3}' \qquad I_{R1} = \frac{V_i}{R_1}$$

$$I_{R2} = \frac{0_V - V_a}{R_2} = -\frac{V_a}{R_2} = -V_o \frac{\$R_3 C}{R_2}$$

$$I_C = \frac{0_V - V_a}{\frac{1}{\$C}} = -V_a \$C = -V_o \$^2 C^2 R_3$$

$$I_{R3}' = \frac{0_V - V_o}{R_3} = -\frac{V_o}{R_3}$$

$$\frac{V_i}{R_1} = -V_o \frac{\$R_3 C}{R_2} - V_o \$^2 C^2 R_3 - \frac{V_o}{R_3}$$

$$\frac{V_i}{R_1} = \therefore V_o \left(\frac{\$R_3^2 C + \$^2 C^2 R_3^2 R_2 + R_2}{R_2 R_3} \right)$$

$$\left[\frac{V_o}{V_i} = \frac{-R_2 R_3}{\$^2 R_1 R_2 R_3^2 C^2 + \$ R_1 R_3^2 C + R_1 R_2} \right]$$

$$\left[\frac{V_o}{V_i} = -\frac{R_3}{R_1} \frac{\frac{1}{R_3^2 C^2}}{\$^2 + \$ \frac{1}{R_2 C} + \frac{1}{R_3^2 C^2}} \right]$$

$$\omega_o^2 = \frac{1}{R_3^2 C^2} \qquad \omega_o = \frac{1}{R_3 C}$$

$$\frac{\omega_o}{Q} = \frac{\frac{1}{R_3 C}}{Q} = \frac{1}{R_2 C} \Rightarrow Q = \frac{R_2}{R_3}$$

$$\left[\frac{V_o}{V_i} = -\frac{R_3}{R_1} \frac{\omega_o^2}{\$^2 + \$ \frac{\omega_o}{Q} + \omega_o^2} \right]$$

$$\left[\omega_o = \frac{1}{R_3 C} \right] \qquad \left[Q = \frac{R_2}{R_3} \right]$$

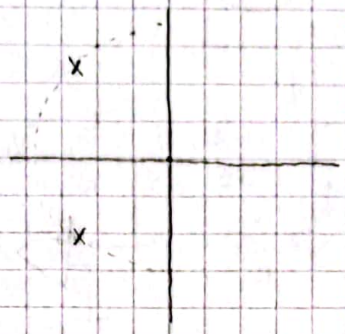
NOTA

② $\omega_0 = \frac{1}{R_3 C} = 1$ $\qquad Q = \frac{R_2}{R_3} = \frac{R_2}{1} = 3$ $\qquad [3R_2 = R_3]$

$\frac{1}{C} = R_3$ $\qquad [R_2 = 3\ \Omega]$

$[R_3 = 1]$ $[C = 1]$

③ $T(\$) = -\frac{R_3}{R_1} \cdot \frac{\omega_0^2}{\$^2 + \$\frac{\omega_0}{Q} + \omega_0^2}$



$20 \log\left(\frac{1}{R_1}\right) = 20\,dB$

$\log\left(\frac{1}{R_1}\right) = 1$ $\qquad \left[T(\$) = -\frac{10}{\$^2 + \$\frac{1}{3} + 1}\right]$

$[10R_1 = R_3]$ $\qquad [R_1 = 0,1]$

④ $\Omega_\omega = \omega_0$ $\qquad \overline{T}(\$) = T(\$)\Big|_{\$ = \# \omega_0} = -\frac{R_3}{R_1} \cdot \frac{\omega_0^2}{\#^2\omega_0^2 + \#\frac{\omega_0^2}{Q} + \omega_0^2}$

$\left[\overline{T}(\#) = -\frac{R_3}{R_1} \frac{1}{\#^2 + \#\frac{1}{Q} + 1}\right]$

$\omega_0^2 = 1 = \frac{1}{R_3^2 C^2} \Rightarrow \frac{1}{R_3} = C$ $\qquad [\Omega_z = R_3 = 1]$

- R_1 = ELIJO/INDEPENDIENTE
- $C = 1$
- $Q = \frac{R_2}{R_3} \Rightarrow [R_2 = Q]$
- $R_1 = 0,1$

$\frac{V_i}{R_1} =$

NOTA

HOJA N°

FECHA

Transferencia Butterworth

$$T(\$) = -\frac{R_2}{R_1}\,\frac{\omega_0^2}{\$^2 + \frac{\omega_0}{Q}\$ + \omega_0^2} \qquad \omega_0 = \frac{1}{R_3 C} \qquad Q = \frac{R_2}{R_3}$$

Buter $\rightarrow \xi = 1 \rightarrow \alpha(\omega=\omega_0) = -3\,dB$

$$T(\$) = \frac{1}{\$^2 + \$\sqrt{2} + 1} \qquad \omega_0 = 1 \qquad Q = \frac{1}{\sqrt{2}} = \frac{R_2}{R_3} \rightarrow \boxed{R_3 = 1} \quad \boxed{R_2 = \sqrt{2}}$$

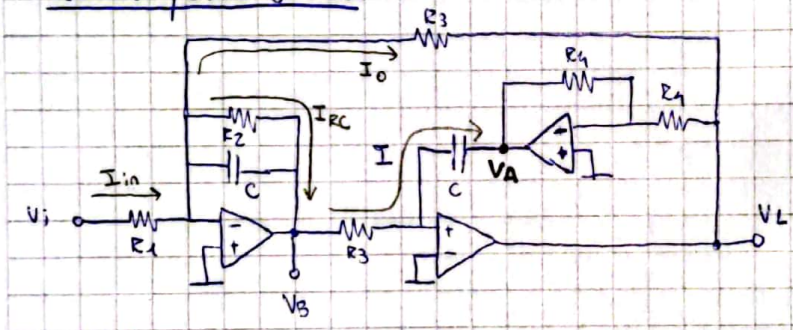
$\boxed{R3=1}$ $\boxed{C=1}$

Los valores de los demás componentes se repiten

$\boxed{R_1 = 1}$ → Para no tener ganancia

$\boxed{R_4}$ → Arbitrario

Salida para banda



$\boxed{V_A = -V_L}$ → Por inversor

$$I = \frac{V_B}{R_3} = -V_A \$C = V_L \$C \rightarrow \boxed{V_B = V_L \cdot \$R_3 C} \rightarrow \boxed{V_L = \frac{V_B}{\$R_3 C}}$$

$$I_{in} = I_o + I_{RC}$$

$$\frac{V_i}{R_1} = \frac{V_L}{R_3} + V_B \cdot \frac{\$CR_2 + 1}{R_2}$$

$$\frac{V_i}{R_1} = V_B\left(\frac{\$CR_2 + 1}{R_2} + \frac{1}{\$R_3^2 C}\right)$$

$$\frac{V_i}{R_1} = V_B\,\frac{\$^2 R_2 R_3^2 C^2 + \$R_3^2 C + R_2}{\$R_2 R_3^2 C}$$

$$\frac{V_B}{V_i} = \frac{\$R_2 R_3^2 C/R_1}{\$^2 R_2 R_3^2 C^2 + \$R_3^2 C + R_2}$$

$$\frac{V_B}{V_i} = \frac{\$\frac{1}{R_1 C}\,\frac{R_2}{R_2}}{\$^2 + \$\frac{1}{R_2 C} + \frac{1}{R_3^2 C^2}}$$

$$\left[\frac{V_B}{V_i} = \frac{R_2}{R_1}\,\frac{\$\frac{1}{R_2 C}}{\$^2 + \$\frac{1}{R_2 C} + \frac{1}{R_3^2 C^2}}\right]$$

$$\left[\omega_0 = \frac{1}{R_3 C} = 1\right] \qquad \left[Q = \frac{R_2}{R_3} = 3\right]$$

$$\left[K = \frac{R_2}{R_1} = 30 \rightarrow 29{,}5\,dB\right]$$

NOTA