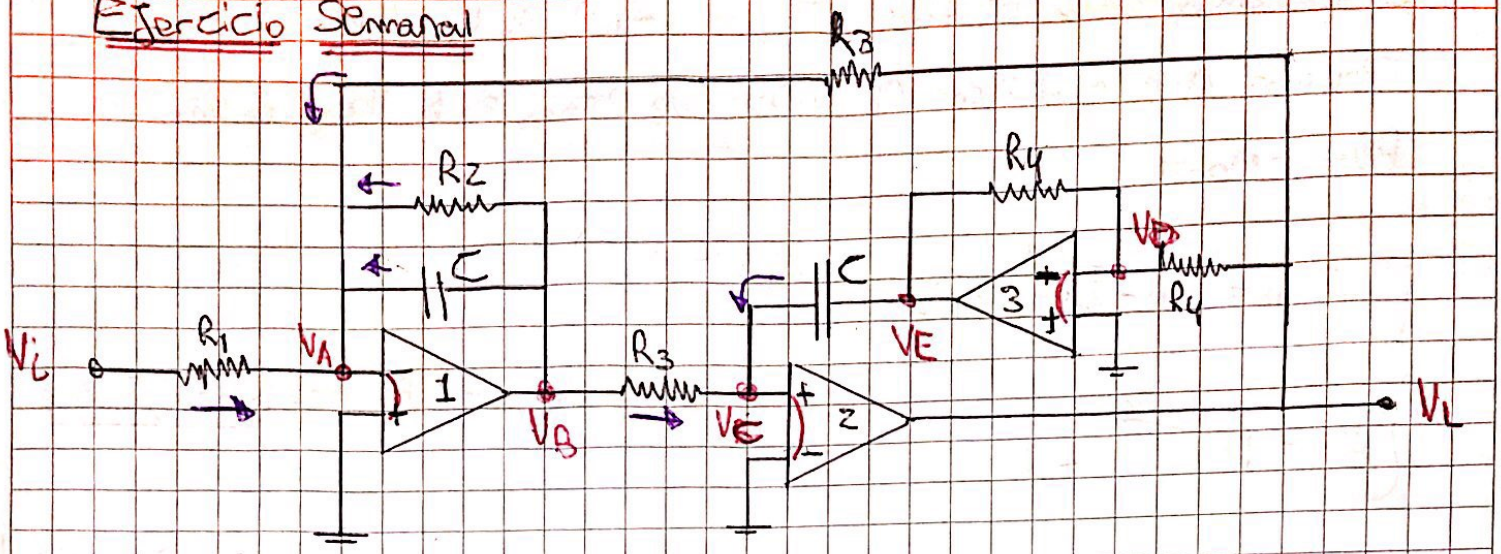
Ejercicio Semanal



Nodo (A):

$$V_i G_1 + V_B(G_2 + sC) + V_b \cdot G_3 = 0 \quad (1)$$

Nodo (B): $V_B \cdot G_3 + V_E \cdot sC = 0 \quad (2)$

Ecuación inversor (3): $V_E = -V_b \quad (3)$

Nota: Supongo Correcta Realimentación ⊕ y ⊖ en Todas las OPAMP

(3) → (2)

$$V_B \cdot G_3 = V_b \, sC \Rightarrow \boxed{V_B = V_b \cdot \frac{sC}{G_3}} \quad (4)$$

(4) → (1)

$$V_i G_1 + V_b \frac{sC}{G_3}(G_2 + sC) + V_b G_3 = 0$$

$$V_i G_1 + V_b \left(\frac{s^2C^2 + sCG_2 + G_3^2}{G_3} \right) = 0$$

$$\boxed{\frac{V_L}{V_i} = -\frac{G_1 G_3}{s^2C^2 + sCG_2 + G_3^2} = \frac{-1/R_1R_3C^2}{s^2 + s\cdot\left(\frac{1}{R_2C}\right) + \frac{1}{R_3^2C^2}}}$$

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(A) Retomando, se puede escribir la Transferencia como:

$$T_L(s) = \frac{V_L}{V_i} = -\frac{R_3}{R_1} \cdot \frac{\frac{1}{R_3^2 C^2}}{s^2 + s\left(\frac{1}{R_2 C}\right) + \frac{1}{R_3^2 C^2}}$$

donde $\omega_0^2 = \frac{1}{R_3^2 C^2} \Rightarrow \boxed{\omega_0 = \frac{1}{R_3 C}}$

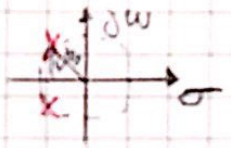
R_4 No afecta en la Transferencia ideal

$$\frac{\omega_0}{Q} = \frac{1}{R_2 C} \Rightarrow \boxed{Q = \omega_0 \cdot R_2 C = \frac{R_2}{R_3}}$$

$$\boxed{K = -\frac{R_3}{R_1}}$$

$$\boxed{T_L = K \frac{\omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}} \longrightarrow \text{Pasa Bajos segundo orden.}$$

$$Q = \frac{\omega_0}{2\cos\theta}$$



(B) $\omega_0 = 1 = \frac{1}{R_3 C} \Rightarrow$ Tomando $\boxed{R_3 = 1K\Omega} \Rightarrow \boxed{C = 1mF}$

$$Q = 10 = \frac{R_2}{R_3} \Rightarrow \boxed{R_2 = 10K\Omega}$$

(C) Si: $K = 20dB = +2\log\left(+\frac{R_3}{R_1}\right) \Rightarrow \log\left(+\frac{R_3}{R_1}\right) = +1$

$$\frac{R_3}{R_1} = 10 \Rightarrow R_1 = \frac{R_3}{10} \Rightarrow \boxed{R_1 = 0,1K\Omega = 100\Omega}$$

Tomamos arbitrariamente $\boxed{R_4 = 1K\Omega}$

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Si queremos obtener una salida pasa banda es tan simple como calcular la Transferencia de $\frac{V_B}{V_i}$

$$T_B(s) = \frac{V_B}{V_i} = \frac{V_L}{V_i} \cdot s R_2 C = K R_3 C \cdot \frac{s \omega_0^2}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$$

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