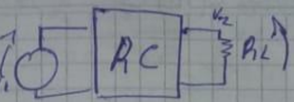
$\boxed{1}$

$$-\frac{I_2}{I_1} = H\,\frac{s^2+5s+4}{s^2+8s+12} \quad ;$$



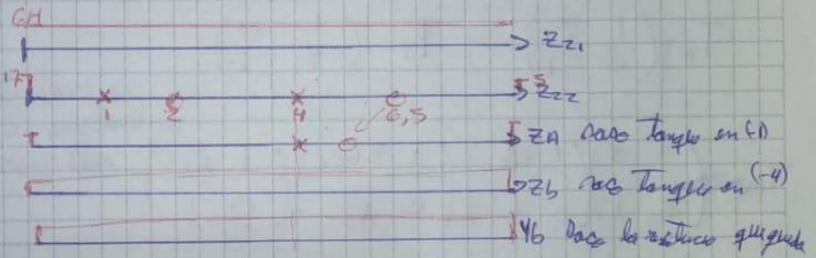
$Z_{21} = 6H$

$$V_2 = I_1 Z_{21} + I_2 Z_{22} \quad ; \quad V_2 = -I_2 R_L$$

$$-\frac{I_2}{I_1} = \frac{Z_{21}}{Z_{22}+R_L}$$; Consideramos $R_L = 1$ normalizando el circuito a su valor

$$\frac{\overset{6H}{\uparrow}}{}\;\frac{Z_{21}}{Z_{22}+1} = H\,\frac{s^2+5s+4}{s^2+8s+12} \rightarrow Z_{22} = \frac{6(s^2+8s+12)}{s^2+5s+4} - 1$$

$$Z_{22} = \frac{5s^2+43s+68}{s^2+5s+4}$$



$$Z_{RC} = \frac{1/C}{s+\frac{1}{RC}}$$

$$1/C_1 = \lim_{s \to \omega_1} Z_{22}(s)(s+\omega_1) = \frac{5s^2+43s+68}{\cancel{(s+1)}(s+4)}\cancel{(s+1)} = 10 \rightarrow \boxed{C_1 = 1/10}$$

$$\frac{1}{C_1 R_1} = 1 \; ; \; \boxed{R_1 = 10}$$

$$Z_A = \frac{5s^2+43s+68}{(s+1)(s+4)} - \frac{10}{s+1} = \frac{5s^2+33s+28}{(s+1)(s+4)} = \frac{5\cancel{(s+1)}(s+\frac{28}{5})}{\cancel{(s+1)}(s+4)}$$

$$\boxed{Z_A = \frac{(s+\frac{28}{5})5}{s+4}}$$

$$\frac{1}{C_2} = \lim_{s \to 4} \frac{5\left(s + \frac{28}{5}\right)}{\cancel{s+4}} \cancel{(s+4)} = \cancel{5,6}\, 8 \qquad \boxed{C_2 = \cancel{0,625}\ \tfrac{1}{8}}$$

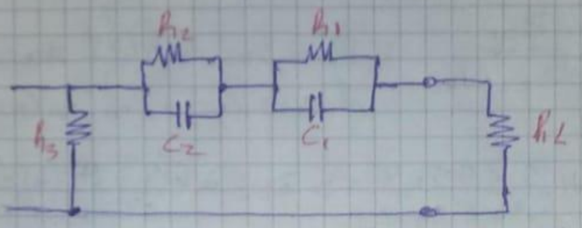
$$\frac{1}{C_2 R_2} = 4$$

$$\boxed{\cancel{R_2 = \tfrac{28}{5}}\ 0,4}$$

$$\boxed{R_2 = 2}$$

$$Z_b = \frac{5\left(s + \frac{28}{5}\right)}{s+4} - \frac{\cancel{1,6}\,8}{s+4} = \frac{5(s+4)}{s+4} = \boxed{5}$$

$\uparrow$ R_3



$R_1 = 10$; $C_1 = 1/10$; $R_2 = \cancel{\tfrac{28}{5}}\ 2$; $C_2 = \cancel{0,625}\ 1/8$; $R_3 = 5$

$R_L = 1$

$$T_Z = \begin{pmatrix} 1 & Z \\ 0 & 1 \end{pmatrix} \; ; \; T_Y = \begin{pmatrix} 1 & 0 \\ Y & 1 \end{pmatrix}$$

Se pone como Z por condiciones de indicación de cuadripolo

$$T_{total} = \begin{pmatrix} 1 & 0 \\ 1/R_3 & 1 \end{pmatrix} \begin{pmatrix} 1 & ZRC_2 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & ZRC_1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & R_L \\ 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & ZRC_2 \\ 1/R_3 & \frac{ZRC_2}{R_3}+1 \end{pmatrix} \begin{pmatrix} 1 & R_L + ZRC_1 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & R_L + ZRC_1 + ZRC_2 \\ 1/R_3 & \frac{R_L + ZRC_1}{R_3} + \frac{ZRC_2}{R_3} + 1 \end{pmatrix}$$

$$V_1 = V_2 a + (-I_2) b$$

$$I_1 = V_2 c + (-I_2) D$$

$$D\Big|_{V_2 = 0} = \frac{I_1}{-I_2}$$

$$D\big|_{V_2=0} = \frac{1}{5} + \frac{10/5}{S+1} + \frac{8/5}{S+4} + 1 = \frac{1{,}2\,(S+1)(S+4) + 2\,(S+4) + \frac{8}{5}(S+1)}{(S+1)(S+4)}$$

$$D\big|_{V_2=0} = \frac{1{,}2\,S^2 + 6\,S + 4{,}8 + 2\,S + 8 + \frac{8}{5}\,S + \frac{8}{5}}{S^2 + 5\,S + 4}$$

$$D\big|_{V_2=0} = \frac{1{,}2\,S^2 + 9{,}6\,S + 14{,}4}{S^2 + 5S + 4}$$

$$\frac{1}{D} = \frac{-I_2}{I_1} = \frac{S^2 + 5S + 4}{1{,}2S^2 + 9{,}6\,S + 14{,}4}$$

$$\boxed{H = \frac{5}{6}}$$

$\boxed{2}$ $T(s) = \dfrac{V_2}{I_1} = \dfrac{K(s^2+9)}{s^3+2s^2+2s+1}$

$V_1 = z_{11} I_1 + z_{12} I_2$ $\qquad V_2 = -I_2 R_L$

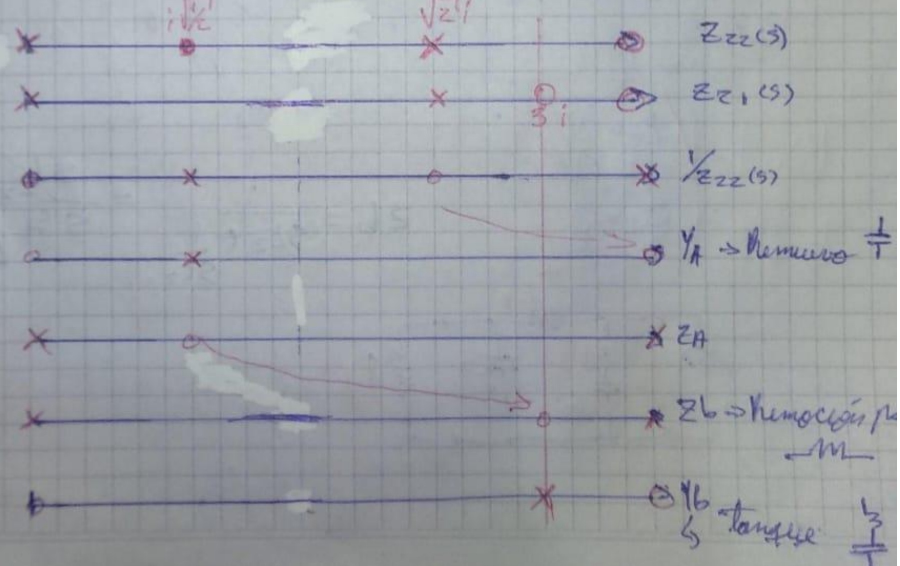
$V_2 = z_{21} I_1 + z_{22} I_2$ $\qquad \hookrightarrow I_2 = -\dfrac{V_2}{R_L}$

$V_2\left(1+\dfrac{1}{R_L} z_{22}\right) = z_{21} I_1$

$T(s) = \dfrac{z_{21}}{1+\dfrac{z_{22}}{R_L}}$ → Normalizo respecto a $R_L = 1$

$T(s) = \dfrac{z_{21}}{1+z_{22}} = \dfrac{K(s^2+9)}{s^3+2s+2s^2+1} = \dfrac{\dfrac{K(s^2+9)}{s^3+2s}}{1+\dfrac{2s^2+1}{s^3+2s}}$

$z_{22} = \dfrac{2s^2+1}{s^3+2s}$; $z_{21} = \dfrac{K(s^2+9)}{s(s^2+2)}$



$$1/Z_{22} = \frac{s^3+2s}{2s^2+1}$$

$$Y_A = 1/Z_{22} - sC_1$$

$$C_1 = \lim_{s\to\infty} \frac{\cancel{s}(s^2+2)}{\cancel{s}(2s^2+1)} = \boxed{1/2 = C_1}$$

$$Y_A = \frac{s^3+2s}{2s^2+1} - \frac{s}{2} = \frac{\cancel{s^3}+2s-\cancel{s^3}-s/2}{2s^2+1} = \frac{\frac{3}{2}s}{2s^2+1}$$

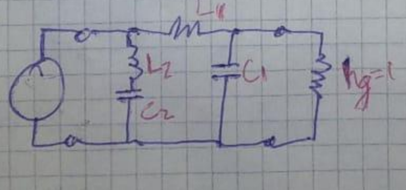
$$Z_A = \frac{2s^2+1}{\frac{3}{2}s} \; ; \quad L_1 = \lim_{s^2\to -9} \frac{2s^2+1}{\frac{3}{2}s^2} = \frac{-2\cdot 9+1}{\frac{3}{2}(-9)} = \boxed{\frac{34}{27} = L_1}$$

$$Z_b = Z_A - sL_1 = \frac{2s^2+1}{\frac{3}{2}s} - \frac{34}{27}s = \frac{\frac{1}{9}s^2+1}{\frac{3}{2}s}$$

$$Z_b = \frac{s^2+9}{\frac{27}{2}s} \to Y_b = \frac{\frac{27}{2}s}{s^2+9} = \frac{1}{\underbrace{s\frac{2}{27}}_{L_2} + \underbrace{\frac{2}{3}\frac{1}{s}}_{C_2}}$$

$$\boxed{L_2 = \frac{2}{27}}$$

$$\boxed{C_2 = \frac{3}{2}}$$



$$T_{TOTAL} = \begin{pmatrix} 1 & 0 \\ Y_{LC_2} & 1 \end{pmatrix} \begin{pmatrix} 1 & SL_1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ SC_1 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ G_L & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & SL_1 \\ Y_{LC_2} & Y_{LC_2} SL_1 + 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ SC + G_L & 1 \end{pmatrix}$$

$$= \begin{pmatrix} SL_1(SC_1 + G_L) + 1 & SL \\ Y_{LC_2} + (Y_{LC_2} SL_1 + 1)(SC + G_L) & Y_{LC_2} SL + 1 \end{pmatrix}$$

$$\left.\frac{V_2}{I_1}\right|_{I_2=0} = \frac{1}{C}$$

$$C = Y_{LC_2} + (Y_{LC_2} SL_1 + 1)(SC_1 + G_L)$$

$$C = \frac{S\,{}^1\!/_{L_2}}{S^2 + {}^1\!/_{C_2 L_2}} + \left(\frac{S^2 \frac{L_1}{L_2}}{S^2 + {}^1\!/_{L_2C_2}} + 1\right)(SC_1 + G_L)$$

$$C = \frac{1}{S^2+9}\left(S\,{}^1\!/_{L_2} + \left(S^2\left(\frac{L_1}{L_2}+1\right) + 9\right)\left(S\,{}^1\!/_2 + 1\right)\right)$$

$$C = \frac{1}{S^2+9}\left(S\,{}^1\!/_{L_2} + S^3 \frac{\left(\frac{L_1}{L_2}+1\right)}{2} + S^2\left(\frac{L_1}{L_2}+1\right) + S\frac{9}{2} + 9\right)$$

$$C = \frac{1}{S^2+9}\left(S^3 \frac{\left(\frac{L_1}{L_2}+1\right)}{2} + S^2\left(\frac{L_1}{L_2}+1\right) + S\left(\frac{9}{2} + {}^1\!/_{L_2}\right) + 9\right)$$

$$C = \frac{1}{S^2+9}\left(S^3 \frac{(17+1)}{2} + S^2(17+1) + S\ 18 + 9\right)$$

$$C = \frac{9\,(S^3 + 2S^2 + 2S + 1)}{S^2+9}$$

$$\left.Z_{22}\right|_{I_2=0} = \frac{(S^2+9)\,{}^1\!/_9}{S^3 + 2S^2 + 2S + 1} \leftarrow K = {}^1\!/_9$$