Prob 2

a. Def recíprocidad. Ver teórico del curso

b. El cuadripolo tiene una fuente dependiente. No se puede aplicar el teorema

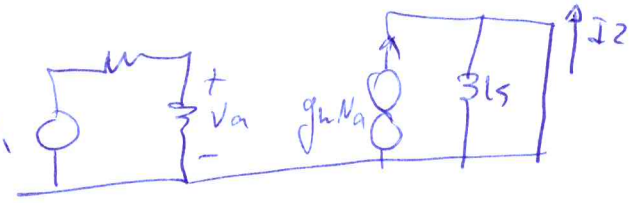
c.
$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$Y_{11} = \left.\frac{I_1}{V_1}\right|_{V_2=0} = \frac{1}{R_1+R_2}$$

$$Y_{22} = \left.\frac{I_2}{V_2}\right|_{V_1=0} = \frac{1}{LS}$$

$$Y_{12} = \left.\frac{I_1}{V_2}\right|_{V_1=0} = 0$$

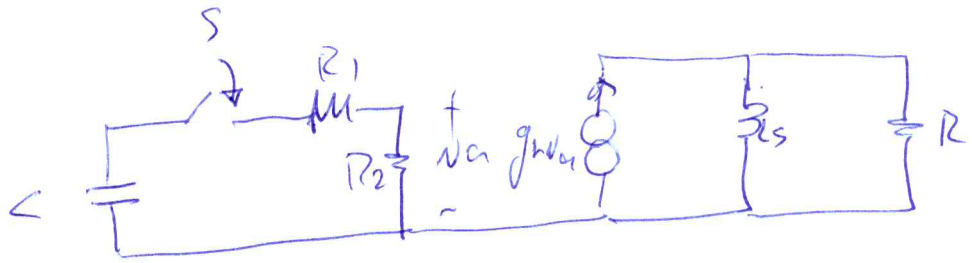
$$Y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2=0}$$



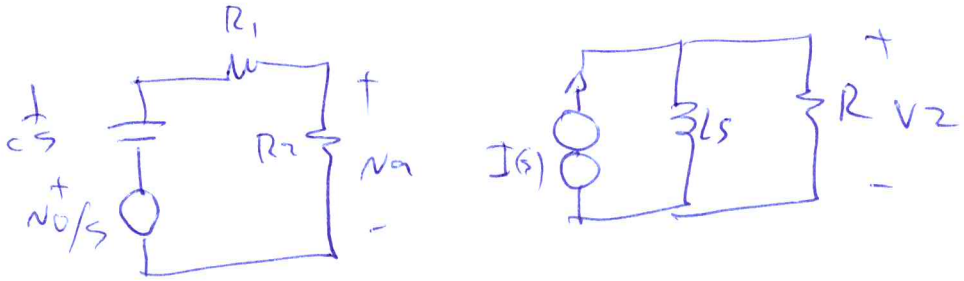
$$V_a = \frac{R_2}{R_1+R_2} V_1$$

$$I_2 = -g_m V_a = -\frac{g_m R_2}{R_1+R_2} V_1$$

$$\Rightarrow Y_{21} = -\frac{g_m R_2}{R_1+R_2}$$



transf. $\quad 0 \le t < L/R$.



$$V_a(s) = \frac{V_0}{s} \cdot \frac{R_2}{R_1 + R_2 + 1/Cs} = \frac{R_2 Cs}{RCs+1} \cdot \frac{V_0}{s} = \frac{R_2 C V_0}{RCs+1}$$

$$V_2(s) = \frac{Ls}{R+Ls} I(s) = \frac{Ls}{R+Ls} g_m \frac{R_2 C V_0}{RCs+1}$$

$$= \frac{g_m R_2 L C V_0 \; s}{(R+Ls)(RCs+1)} = \frac{g_m \frac{R_2}{R} V_0 \; s}{\left(s+\frac{R}{L}\right)\left(s+\frac{1}{RC}\right)}$$

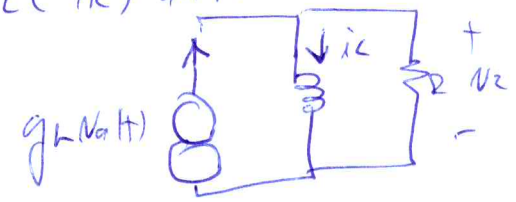
$$\frac{R}{L} = \frac{1}{RC} \triangleq \omega_0$$

$$\begin{cases} V_c(t) = V_0 \, e^{-\frac{t}{RC}} & t \in [0, L/R] \\ V_2(t) = g_m \frac{R_2 V_0}{R} \left[1 - \omega_0 t\right] e^{\omega_0 t} & t \in [0, L/R] \end{cases}$$

TRAMO 2 $\quad t \geq L/R = \tau_C = \omega_0^{-1}$

$$\boxed{\begin{aligned} v_{o_1}(t) &= 0 \\ v_C(t) &= v_C(L/R) = v_0/e \end{aligned}}$$

Precisamos el dato previo: $i_L(L/R)$ antes de abrir la llave



$$i_L(t) = g_m v_{o_1}(t) - \frac{v_2(t)}{R}$$

$$\Rightarrow i_L(L/R) = \underbrace{g_m v_{o_1}(L/R)}_{\text{en el tramo I}} - \frac{v_2(L/R)}{R} = g_m v_0 \frac{R_2}{R} e^{-t/\tau_C} - g_m \frac{R_2}{R} v_0 \underbrace{\left(1 - \frac{\omega_0}{\omega_0}\right)}_{=0} e^{-t/\tau_C}$$

$$\Rightarrow \boxed{i_L(L/R) = g_m \frac{R_2}{R} \frac{v_0}{e}}$$

$$i_L(t) \Big|_{t \geq L/R} = g_m \frac{R_2}{R} \frac{v_0}{e} e^{-t/(L/R)}$$

$$\boxed{v_2(t) = -R\, i_L(t) = -g_m R_2 \frac{v_0}{e} e^{-\omega_0 (t - L/R)} \quad \forall\, t \geq L/R}$$