Nombre: Clave

INEL 3105: Análisis de Circuitos Eléctricos I

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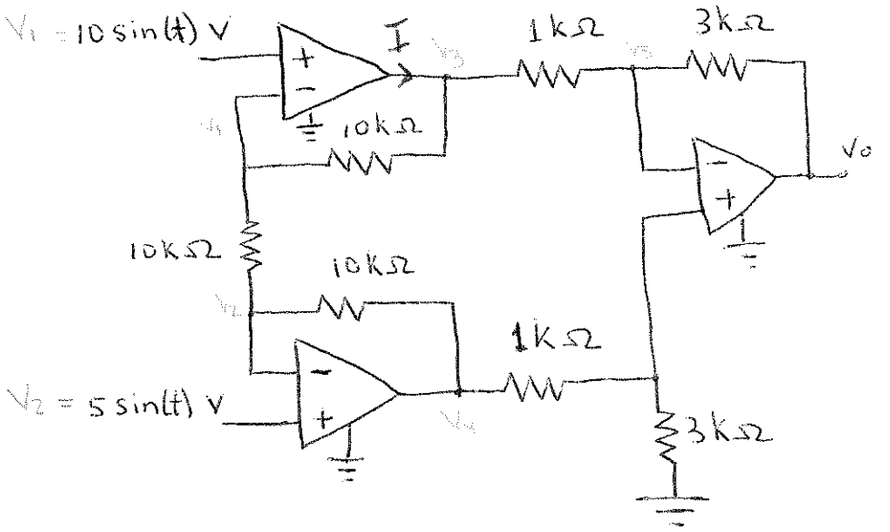
27 de marzo de 2008

Examen # 2

I. Halle Vo en el siguiente circuito: (30 puntos)



Si se asume I=0; -2

$\frac{V_1 - V_3}{10} + \frac{V_1 - V_4}{10} = 0$ (6) $\quad \frac{V_2 - V_1}{10} + \frac{V_2 - V_4}{10} = 0$ (6) $\quad V_5 = \frac{3}{4} V_4$ (5)

$\Rightarrow V_3 = 2V_1 - V_2$ (1) $\quad V_4 = 2V_2 - V_1$ (1)

$V_3 = 10\sin(t)\ V$ $\quad V_4 = 0\ V$

$\frac{V_3 - V_5}{1} = \frac{V_5 - V_o}{3}$ (6)

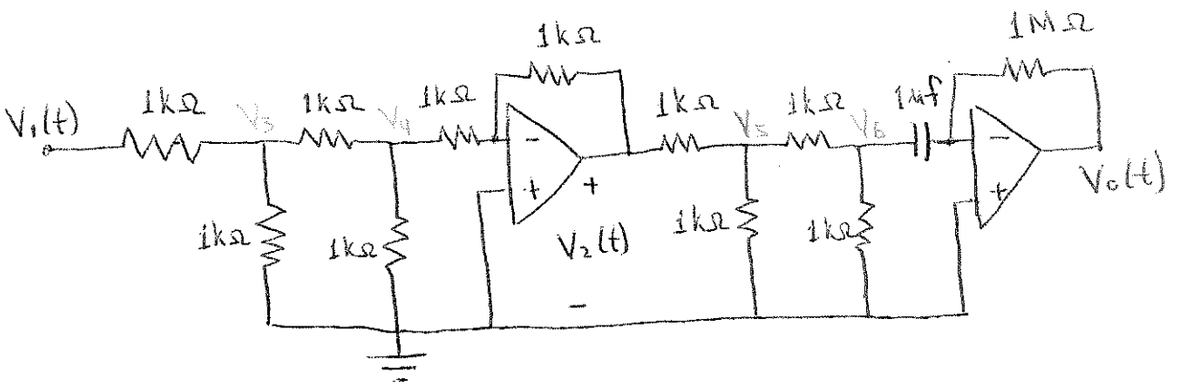
$V_o = 4V_5 - 3V_3$ (1)

$V_o = 4\left(\frac{3}{4}V_4\right) - 3V_3 = 3(V_4 - V_3) = 3(2V_2 - V_1 - 2V_1 + V_2)$

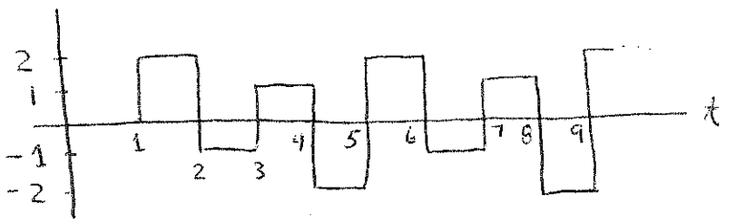
$V_o = 9(V_2 - V_1) = 9(5\sin(t) - 10\sin(t))\ V$ } (2)

$\boxed{V_o = -45\sin(t)\ V}$ (2)

II. Dado la gráfica de salida de $V_0(t)$, determine gráficamente $V_1(t)$ y $V_2(t)$. ~~(25~~ 35 puntos)



$V_0(t)$ voltios



(3) $\frac{V_3 - V_1}{1k} + \frac{V_3}{1k} + \frac{V_3 - V_4}{1k} = 0 \Rightarrow 3V_3 - V_1 - V_4 = 0$ (1)

(3) $\frac{V_4 - V_3}{1k} + \frac{V_4}{1k} + \frac{V_4}{1k} = 0 \Rightarrow 3V_4 = V_3$ (1)

$V_4 = \frac{V_1}{8} = -V_2$

(3) $\frac{V_5 - V_2}{1k} + \frac{V_5}{1k} + \frac{V_5 - V_6}{1k} = 0 \Rightarrow 3V_5 - V_2 - V_6 = 0$ (1)

(3) $\frac{V_6 - V_5}{1k} + \frac{V_6}{1k} + 1\mu f \frac{dV_6}{dt} = 0 \Rightarrow 1m\Omega \frac{dV_6}{dt} + 2V_6 - V_5 = 0$ (1)

(3) $\boxed{1\mu f \frac{dV_6}{dt} = -\frac{V_0}{1M\Omega}}$ * $\Rightarrow \frac{dV_6}{dt} = -\frac{V_0}{neg} \Rightarrow \boxed{V_6 = -\int V_0\, dt}$ ** (1)

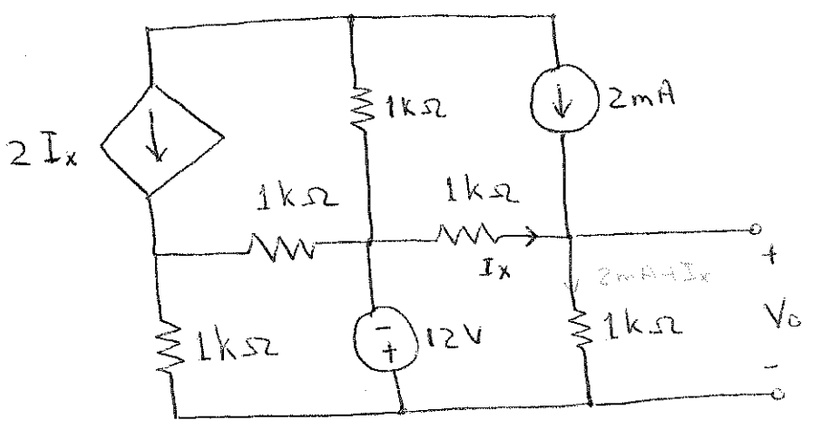
$V_5 = 1m\Omega \dot{V}_6 + 2V_6$

$\Rightarrow 3(1m\Omega \dot{V}_6 + 2V_6) - V_6 = V_2 = 3m\Omega \dot{V}_6 + 5V_6$

$\boxed{V_2(t) = -\frac{3V_0}{1000} - 5\int V_0\, dt}$ (4)

$\boxed{V_1(t) = -8V_2(t)}$ (1)

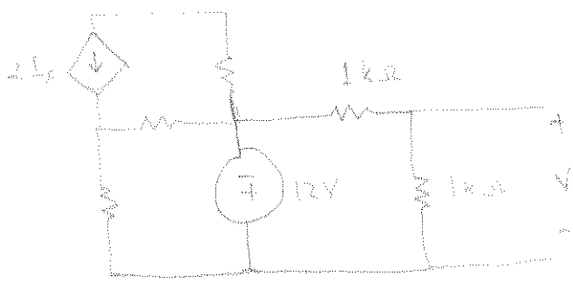
III. Halle Vo. (20 puntos)



Apagar fuente dependiente: ~~20~~ -10

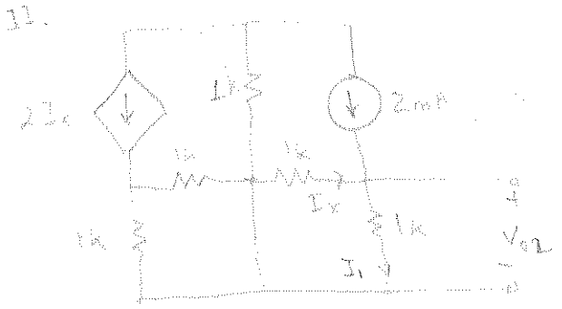
Superposición:

1.



$V_{o1} = -12\left(\frac{1}{2}\right)V = -6V$ (8)

2.



$I_1 = 2mA + I_x$

$V_{o2} = 1k\,I_1 = -1k\,I_x$

$-I_x = 2mA + I_x \;\therefore\; I_x = -1mA$ (10)

$V_{o2} = 1V$

$\Rightarrow \boxed{V_o = V_{o1} + V_{o2} = -5V}$ (2)

Método 2:

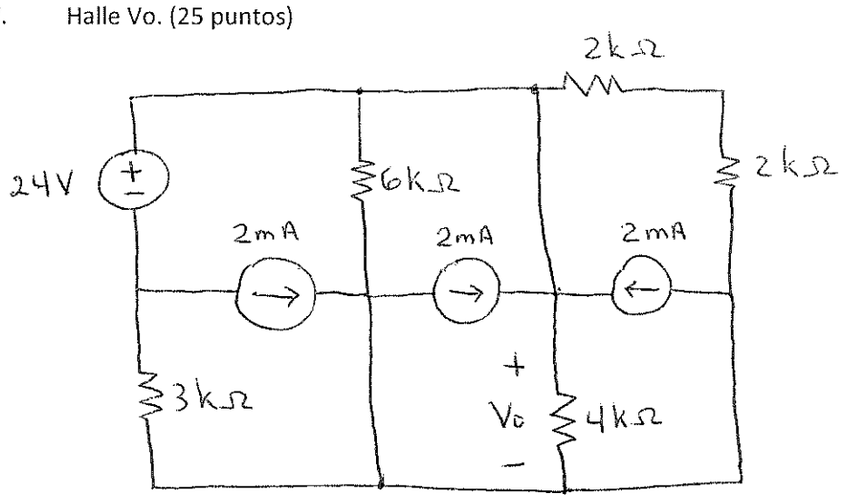
KVL: $12 + (2mA + I_x)1k\Omega + I_x(2k\Omega) = 0$

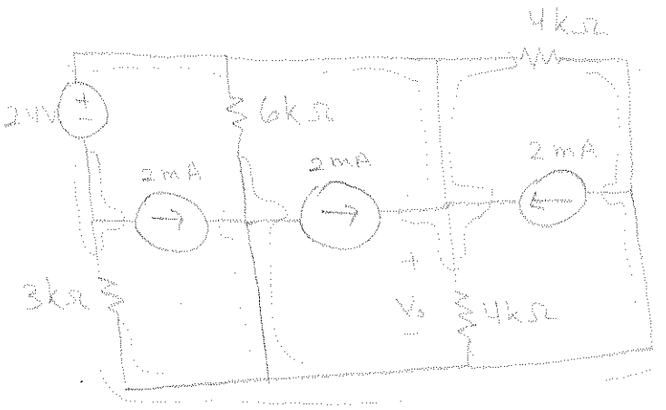
$14 + 2k\,I_x = 0$

$I_x = -7mA$ } (10)

$\therefore V_o = 1k\Omega\,(2mA + I_x) = -5V$ (10)

IV. Halle Vo. (25 puntos)



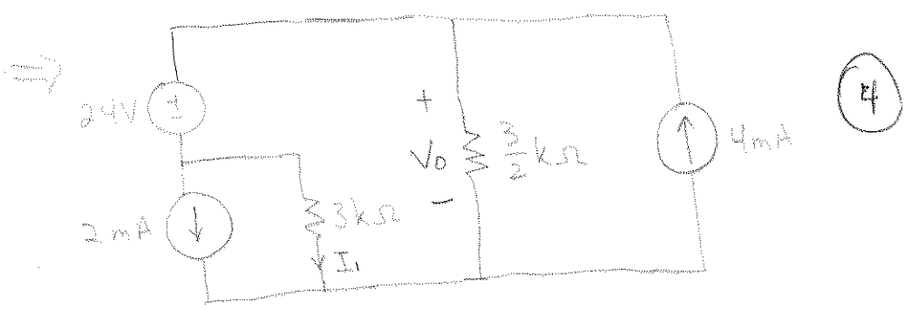


$$\frac{1}{R_p} = \frac{1}{4k} + \frac{1}{4k} + \frac{1}{6k} = \frac{1}{2k} + \frac{1}{6k}$$

$$\frac{1}{R_p} = \frac{3}{12k\Omega} = \frac{1}{3k\Omega}$$

(5)

$$\Rightarrow R_p = \frac{3}{2}k\Omega$$



(4)

Método I:

(6) kcL: $I_1 + 2mA + \frac{V_o}{3/2k\Omega} = 4mA \Rightarrow \frac{3}{2}kI_1 + V_o = 3V$

(6) kvL: $V_o - 2V - 3kI_1 = 0$

$$\Rightarrow \frac{3}{2}k\left(\frac{V_o - 2V}{3k}\right) + V_o = 3V$$

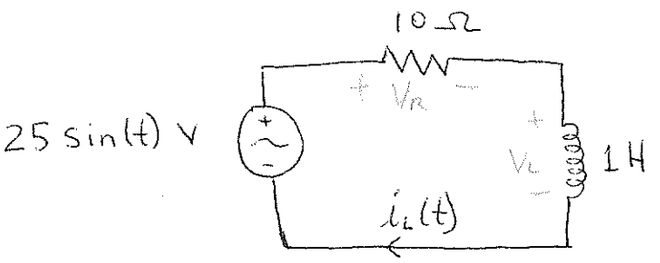
$$V_o - 2V + 2V_o = 6V$$

$$3V_o = 8V$$

(4)

$$\boxed{V_o = 10V}$$

V. Dado el circuito, halle la ecuación que gobierna el comportamiento de la corriente haciendo un KVL. (Bono de 5 puntos)



$$V_R = 10\, i_L(t)$$

$$V_L = 1H \frac{d i_L(t)}{dt}$$

$$25 \sin(t) = 1H \frac{d i_L(t)}{dt} + 10\, i_L(t)$$

① ② ③