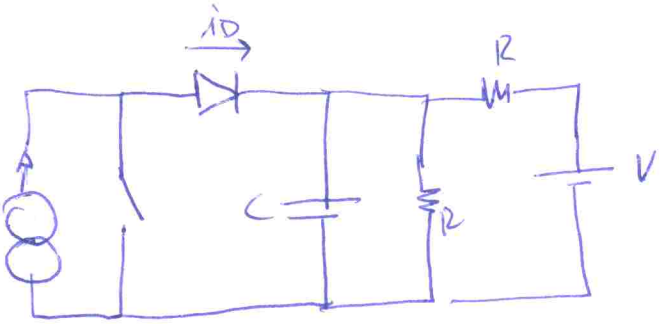
2.a

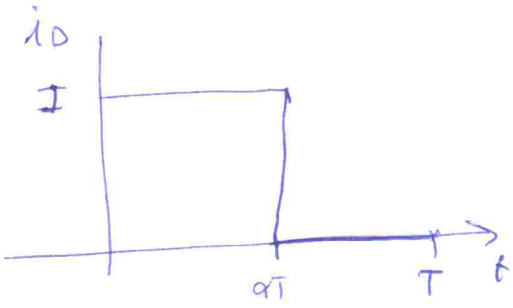


TRAMO 1

S OFF

$0 < t < \alpha T$

D ON Pues $i_D = I > 0$

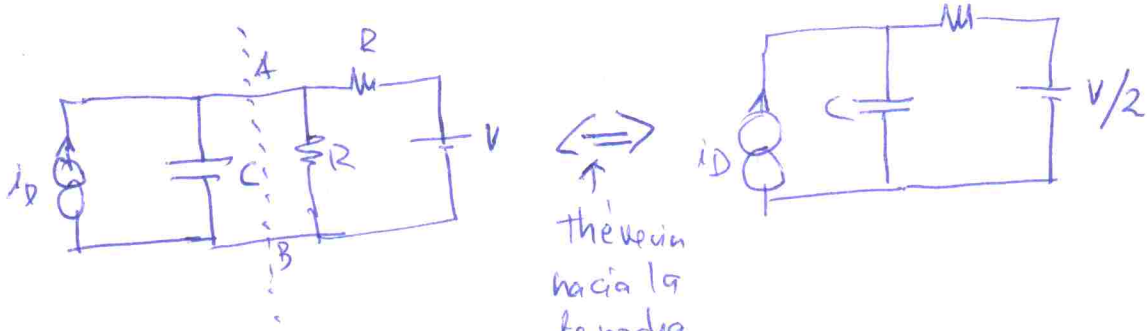


En el TRAMO 2

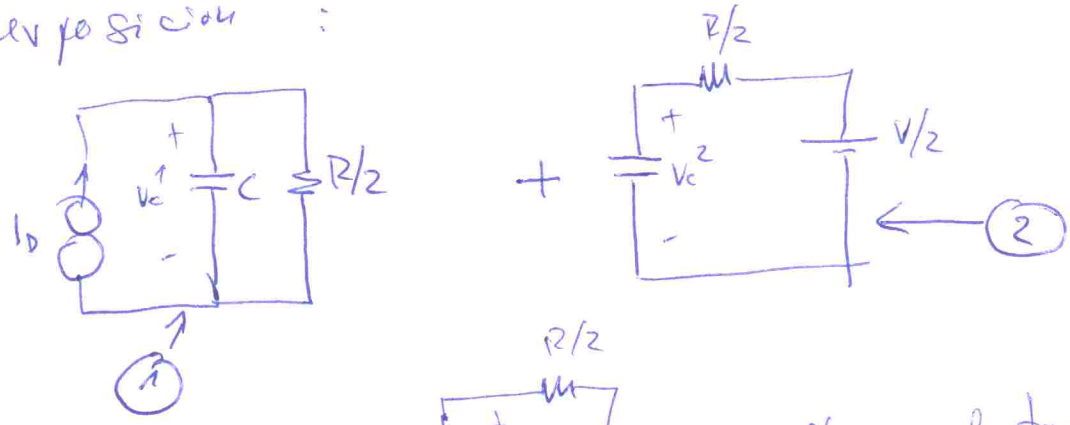
S ON

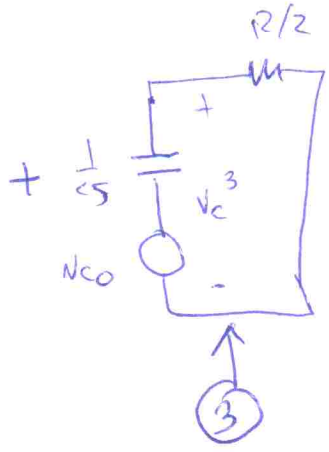
D OFF $\Rightarrow$ $i_D = 0$

$\Rightarrow$ El circuito puede verse equivalente a éste:



Por superposición:





N_{CO} es la tensión en el condensador en $t=0$

CIRCUITO ①

TRAMO 1

$0 < t < \alpha T$

$$V_c^1(s) = \frac{\frac{1}{cs}\,R/2}{\frac{1}{cs}+R/2} \cdot \frac{I}{s} = \frac{RI}{2}\,\frac{1}{1+\frac{RCs}{2}}\,\frac{1}{s}$$

MÁS SENCILLO: $v_c^1(t) = v_f + (v_i - v_f)\,e^{-\frac{2t}{RC}} = \frac{R}{2}I\left[1 - e^{-2t/RC}\right]$

$v_i = 0$

$v_f = \frac{R}{2}I$

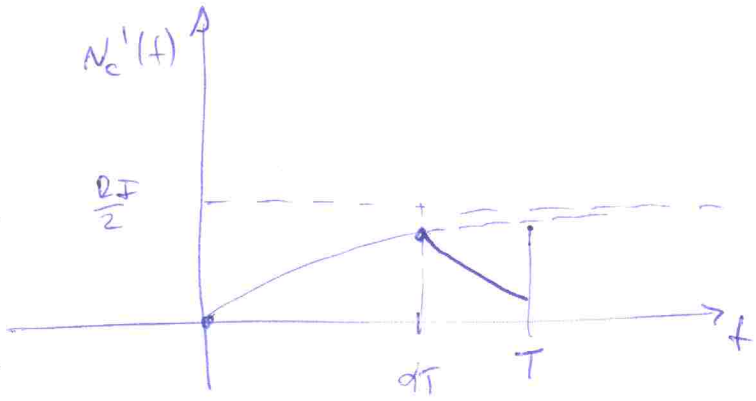
$$v_c^1(\alpha T) = \frac{RI}{2}\left[1 - e^{-\frac{2\alpha T}{RC}}\right]$$

TRAMO 2

$\alpha T < t < T$ DESCARGA DEL CONDENSADOR

$$v_c^1(t) = v_c^1(\alpha T)\, e^{-\frac{2(t-\alpha T)}{RC}}$$

$$v_c^1(t) = \begin{cases} \frac{RI}{2}\left[1 - e^{-2t/RC}\right] & 0 < t < \alpha T \\ v_c^1(\alpha T)\, e^{-\frac{2(t-\alpha T)}{RC}} & \alpha T < t < T \end{cases}$$

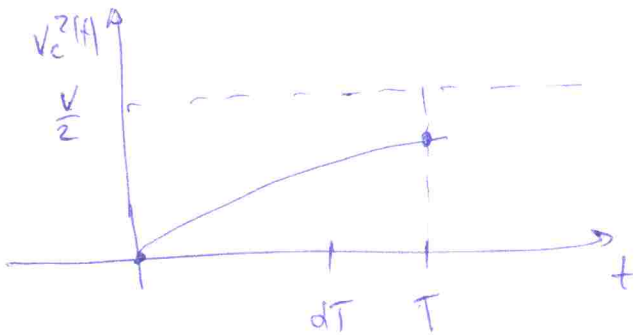


CIRCUITO ②

$$v_c^2(t) = v_f + (v_i - v_f)\,e^{-\frac{2t}{RC}} = \frac{V}{2}\left[1 - e^{-\frac{2t}{RC}}\right] \quad \forall t \in [0,T]$$

$v_f = V/2$

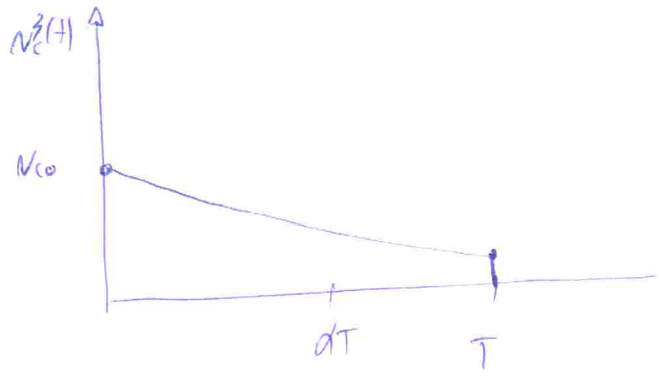
$v_i = 0$



CIRCUITO (3)

Descarga de condensador

$$v_c^3(t) = V_{c0}\, e^{-\frac{2t}{RC}} \qquad \forall t \in [0, T]$$



$$v_c(t) = v_c^1(t) + v_c^2(t) + v_c^3(t)$$

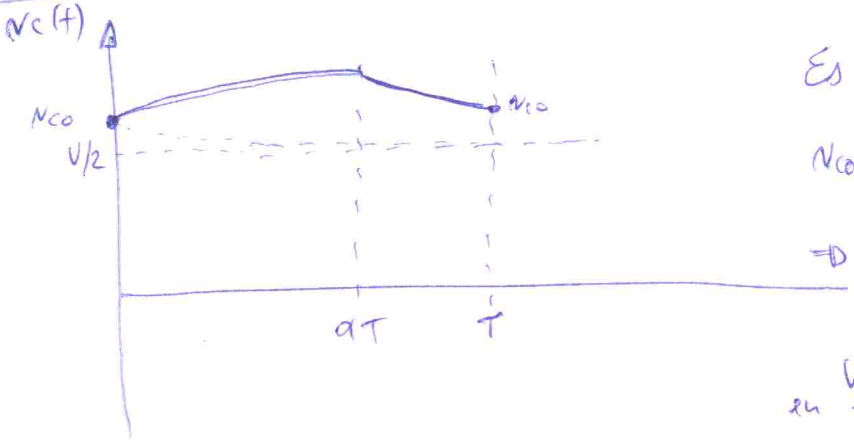
DEBO IGUALAR

$$v_c^1(0) + v_c^2(0) + v_c^3(0) = v_c^1(T) + v_c^2(T) + v_c^3(T)$$

$$0 + 0 + V_{c0} = \frac{RI}{2}\left[1 - e^{-\frac{2\alpha T}{RC}}\right] e^{-\frac{2(1-\alpha)T}{RC}} + \frac{V}{2}\left[1 - e^{-\frac{2T}{RC}}\right] + V_{c0}\, e^{-\frac{2T}{RC}}$$

$$\Rightarrow \boxed{V_{c0} = \frac{V}{2} + \frac{RI}{2}\,\frac{\left(1 - e^{-\frac{2\alpha T}{RC}}\right)}{\left(1 - e^{-2T/RC}\right)}\, e^{-\frac{2(1-\alpha)T}{RC}}}$$

$$\boxed{v_c(t) = v_c^1(t) + v_c^2(t) + v_c^3(t) \quad \text{con el valor de } V_{c0} \text{ calculado}}$$



Es fácil ver que

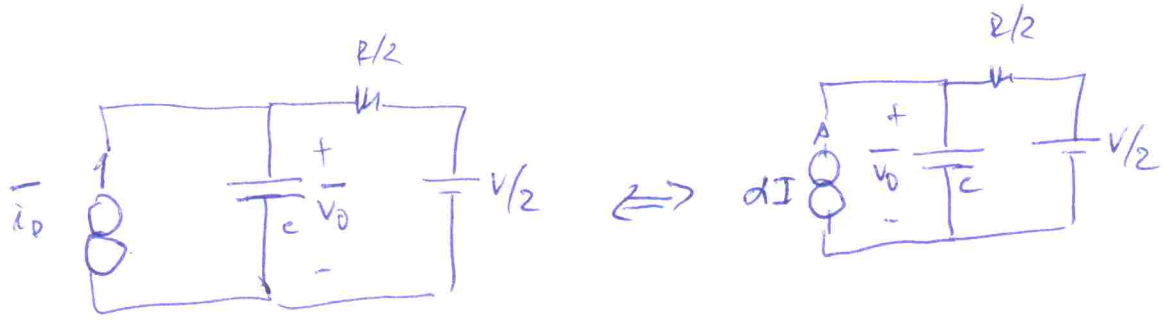
V_{c0} y $v_c(t) > V/2$

$\Rightarrow V_D = -V_0 < 0$ y el Nodo 2 DIODO SE VERIFICA ESTAR OFF en el TRAMO 2.

2.b

CIRCUITO LINEAL EXCITADO POR SEÑALES PERIODICAS

⇒ EL VALOR MEDIO SALE (POR FOURIER) DE EXCITAR EL CIRCUITO CON LOS VALORES MEDIOS DE i_D y V.



$$\bar{V}_0 = \frac{\alpha R I}{2} + \frac{V}{2}$$