NOTES

Quiz 6

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1 a) KVL : $Ri + \frac{1}{C}\int i\,dt = Vs$

$$RI(s) + \frac{1}{C}\left[\frac{I(s)}{s} + \frac{CV_0}{s}\right] = \frac{Vs}{s}$$

$$I(s)\left[R + \frac{1}{Cs}\right] = \frac{Vs - V_0}{s}$$

$$I(s) = \frac{Vs - V_0}{s} \cdot \left[\frac{1}{R + \frac{1}{Cs}}\right] \left[\frac{1}{s + \frac{1}{RC}}\right]$$

$$i(t) = \frac{Vs - V_0}{R} e^{-\frac{t}{RC}}$$

$$V_c(t) = \frac{1}{C}\int_0^t i\,dt$$

$$= \frac{Vs - V_0}{RC}\int_0^t e^{-t/RC}\,dt$$

$$= (Vs - V_0)\,(1 - e^{-t/RC}),$$

$Vc(F) = Vs$ (Fully charged)

b) KVL : $Ri + \frac{1}{C}\int i\,dt = Vs$

$$RI(s) + \frac{1}{C}\left[\frac{I(s)}{s} + \frac{C(-V_0)}{s}\right] = \frac{Vs}{s}$$

$$I(s)\left[R + \frac{1}{Cs}\right] = \frac{Vs + V_0}{s}$$

$$I(s) = \frac{Vs + V_0}{R} \cdot \frac{1}{s + 1/RC}$$

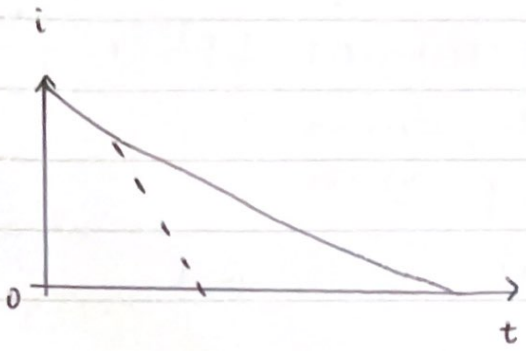
$$i(t) = \frac{Vs + V_0}{R} e^{-t/RC}$$

$$V_c(t) = \frac{1}{C}\int_0^t i\,dt$$

$$= \frac{Vs + V_0}{RC}\int_0^t e^{-t/RC}\,dt$$

$$= (Vs + V_0)\,(1 - e^{-t/RC})$$

$V_c(F) = V_s$ (Fully charged)



NOTES

2. $L\frac{di}{dt} + \frac{1}{C}\int i\,dt = Vs$

Applying Laplace Transform : $L[sI(s) - \overset{0}{\cancel{i(0)}} + \frac{1}{C}\left[\frac{I(s)}{s} + \frac{(-V_0)}{s}\right]$

$= \frac{Vs}{s}$; $i(0) = 0$

$I(s)\left[sL + \frac{1}{sC}\right] = \frac{Vs + V_0}{s}$

$i(t) = (Vs + V_0)\sqrt{\frac{C}{L}}\sin \omega_0 t$

$V_C(t) = \frac{1}{C}(Vs(-V_0))\sqrt{\frac{C}{L}}\int_0^t \sin \omega_0 t\,dt - V_0$

$= (Vs + V_0)(1 - \cos \omega_0 t) - V_0$

$t_0 = \frac{\pi}{\omega_0}$; $\omega_0 = \frac{1}{\sqrt{LC}}$

$= \pi\sqrt{LC}$

$= \pi\sqrt{0.2 \times 10^{-3}\ (10 \times 10^{-6})}$

$= 140.496\,\mu s$

$I_p = (Vs + V_0)\sqrt{\frac{C}{L}}$

$= (230 + 50)\sqrt{\frac{10 \times 10^{-6}}{0.2 \times 10^{-3}}}$

$= 62.61A$

$V_C = 2[Vs - (-V_0)] + (-V_0)$

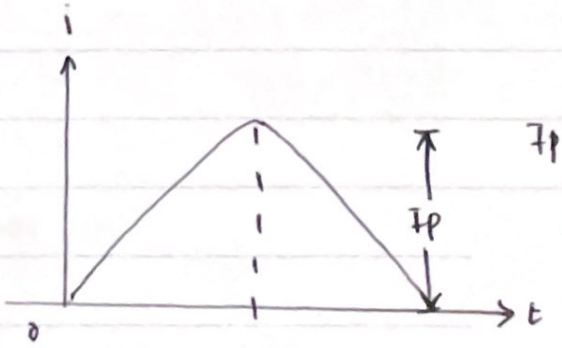
$= 2(230 + 50) - 50$

$= 510\ V$

$V_0 = -V_L - V_C + Vs$

$= 0 - 510 + 230$

$= -280\ V$



$I_p = (Vs + V_0)\sqrt{\frac{C}{L}}$