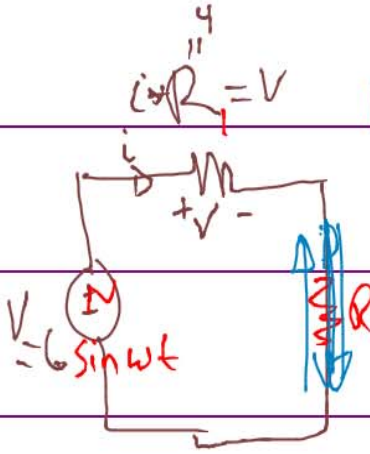
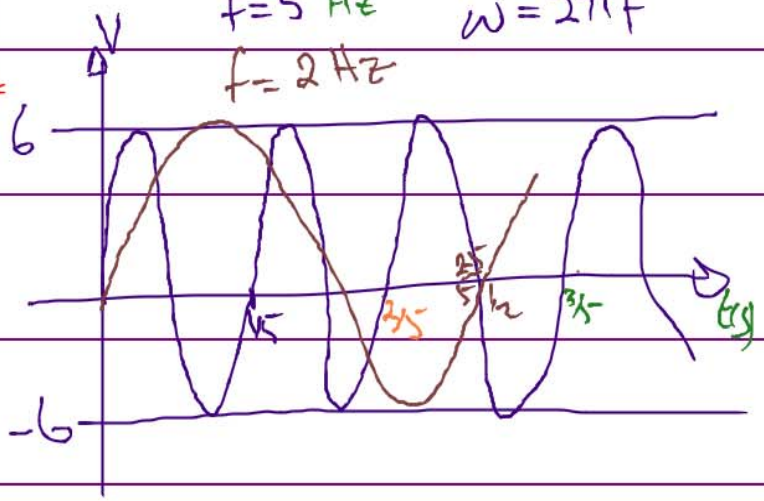
Time domain 6V ± V= ~ 6 sinωt



ω = 2π40
f = 40 Hz
Ht = 5⁻¹



f = 5 Hz
f = 2 Hz
ω = 2πf

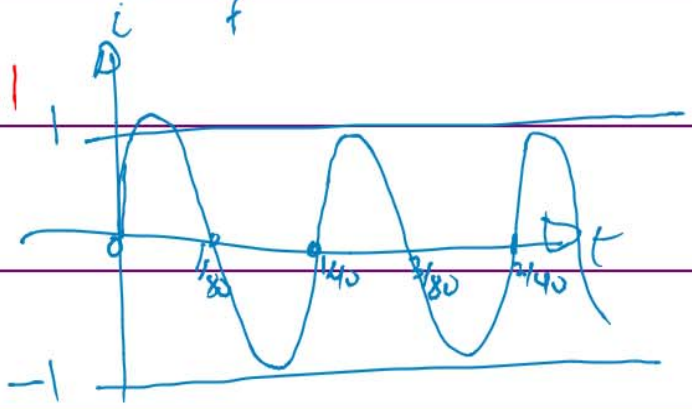
i*4 = 6
i = 6/4 = 1.5A

V = iR
6 sin80πt = i*4 ⇒ i = 1.5 sin 80πt
= 1.5 sin(2π40t)

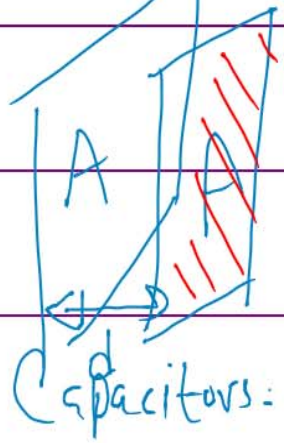
i = 1 sin(2π40t)
f

$\varepsilon_0 = 8.85 * 10^{-12}$

$\chi_{max} = 1$



$C = \chi \frac{\varepsilon_0 A}{d}$



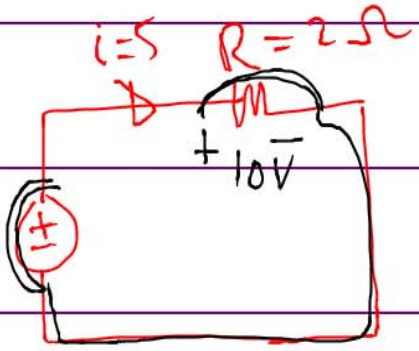
Capacitors:

5→3 . -5→-3

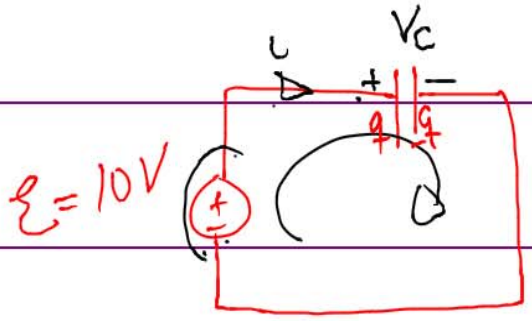
V = V+ - V-

$C = \frac{q}{V}$

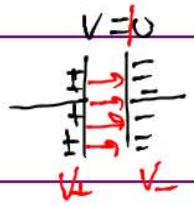
5→3
50→30



$$KVL = \sum V_j = 0$$



$V_c = 10$ Volt



$C = 2\mu F$

$C = \frac{q}{V}$ $\quad \mu = 10^{-6}$

$C = q/V$

$V = q/C$

$2\mu F = q/10V$

$q = 20\mu C$

KVL:

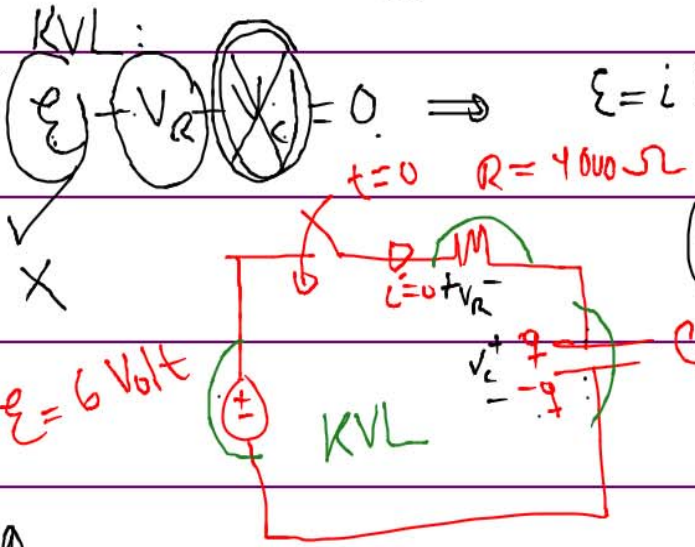
$t=0^+$ $\quad \varepsilon - V_R - V_C = 0 \Rightarrow \varepsilon = iR$

$i = \frac{\varepsilon}{R}$

$V_R = iR$

$C = \mu F$

$= P * 10^{-1}$

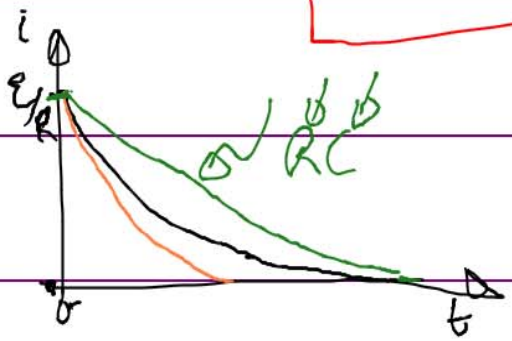


X

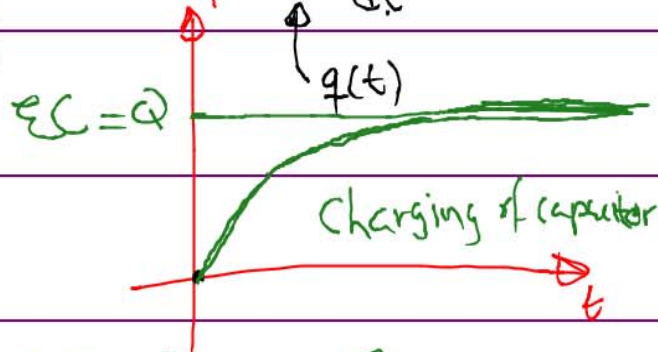
i=0

q: const

$i = \frac{dq}{dt}$



C



$t \to \infty$ $\quad V_C = Q/C = \varepsilon$

$V_R = 0$

$\varepsilon - V_R - V_C = 0 \Rightarrow \varepsilon = V_C = \frac{Q}{C}$

$\mathcal{E} - iR - q/C = 0 \Rightarrow$ $\boxed{\frac{q}{C} + R\frac{dq}{dt} = \mathcal{E}}$

$Q = \mathcal{E}C$

first order linear differential Eqn.

$q(t) = Q\left(1 - e^{-t/RC}\right)$ $\quad e^{-\infty} = 0$

$i(t) = \frac{dq}{dt} = \frac{Q\mathcal{E}}{RC} e^{-t/RC} = \frac{\mathcal{E}}{R} e^{-t/RC}$

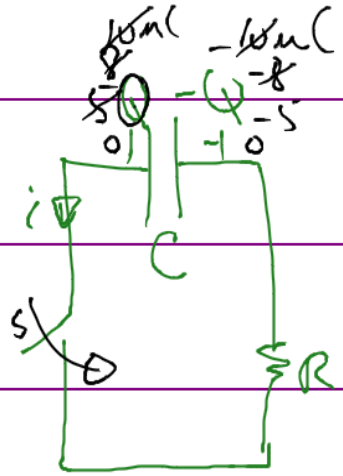
$i(0) = \mathcal{E}/R$

$i(t \to \infty) = 0$

$e^{-10} \approx 0$ $\quad e^0 = 1$ $\quad e^{-\infty} \to 0$

$t = 10\tau$

$RC \equiv \tau$ time constant

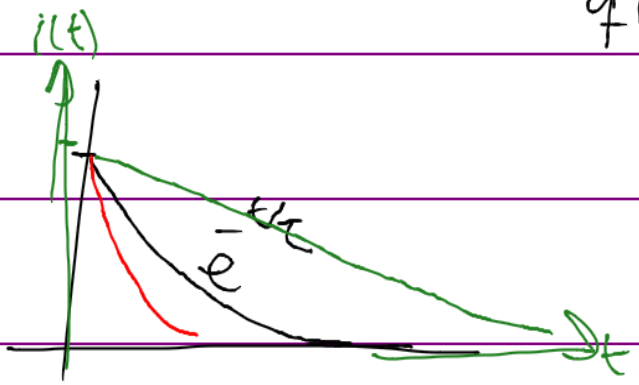


First order circuit

تفریغ discharging $\quad \tau = RC$

$q(t) = Q\, e^{-t/\tau}$

$\simeq 0 \quad t \to \infty \quad e^{-0} = 1$



$t = 10\tau \Rightarrow e^{-10t/\tau} \simeq 0$

$i(t) = \frac{-dq}{dt} = \frac{Q}{\tau} e^{-t/\tau}$

$i(0) = \frac{Q}{\tau} \times 1$

$i(t \to \infty) = \frac{Q}{\tau} e^{-10t/\tau} \to 0$

information

Filters:

demodulation

$\Omega * F = S$

$R = 1000\Omega$

$C = 4\mu F$

$\tau = RC = 400\,\mu\Omega F$

$\simeq 400\,\mu s$

$4ms = 4000\,\mu s$

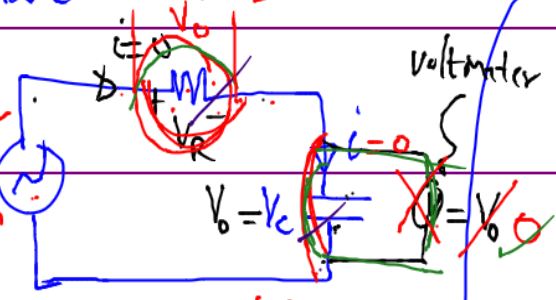
تقريب

إزالة التضمين

$\omega = 2\pi f = \frac{2\pi}{T}$

$V(t) = V_0 \sin \omega t$

$V_R = iR$



V_0, ω

$V(t) = V_1 \sin \omega_1 t + V_2 \sin \omega_2 t$

DC

$\omega = 0$

$V_1 = 4mV \quad \omega_1 = 100$

$V_2 = 6mV \quad \omega_2 = 600{,}000$

$\omega \to 2000000000\ Hz$

$C = \frac{q}{V}$

$V = \frac{q}{C}$

$\frac{dV}{dt} = \frac{1}{C}\frac{dq}{dt}$

$C\frac{dV}{dt} = i$

✓ X

low pass filter ✗

breaking frequency

$R = 1000\Omega$

$C = 4\mu F$

$\omega_B = \frac{1}{RC} = \frac{1}{4 \times 10^{-3}} = \frac{1000}{4} = 250\ Hz$

$\frac{1}{RC} = 1000$

25000

$\omega_B = 1000\ Hz$

LPF

$\omega \ll \omega_B$

$\omega \gg \omega_B$

V_c big ✓

$V_c \sim 0$ ✗

High pass filter

HPF $\omega << \omega_B$ $V \sim 0$

$\omega >> \omega_B$ V big