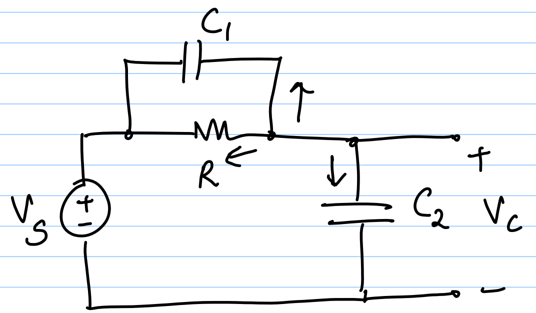
13/3/15

Lec 25



$$C_2 \frac{dV_c}{dt} + \frac{V_c - V_s}{R} + C_1 \frac{d}{dt}(V_c - V_s) = 0$$

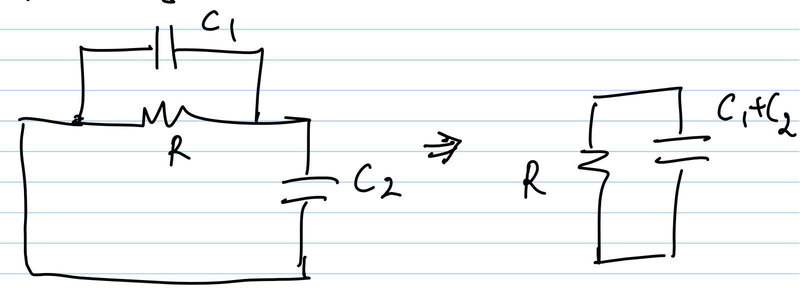
$$(C_1 + C_2)\frac{dV_c}{dt} + \frac{V_c}{R} = \frac{V_s}{R} + C_1 \frac{dV_s}{dt}$$

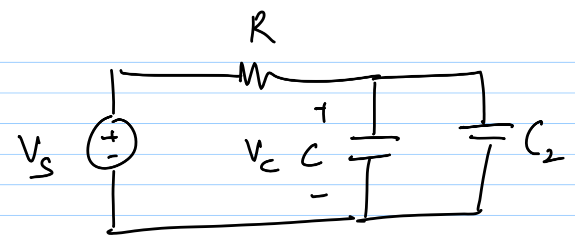
$$\boxed{R(C_1 + C_2)\frac{dV_c}{dt} + V_c = V_s + RC_1 \frac{dV_s}{dt}}$$

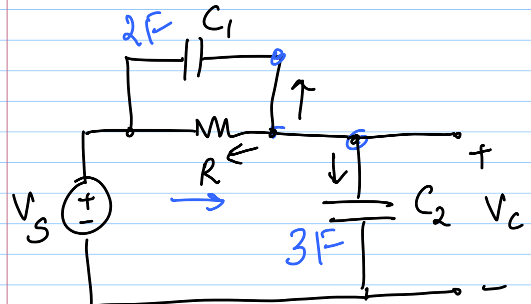
→ 1st order system

→ $R(C_1+C_2)$ is the time constant

If you set $V_s = 0$

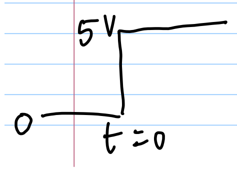






$V_c(0^-) = 0$

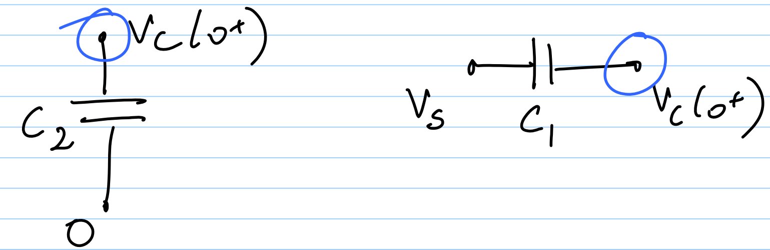
$V_{c_1}(0^-) = 0$



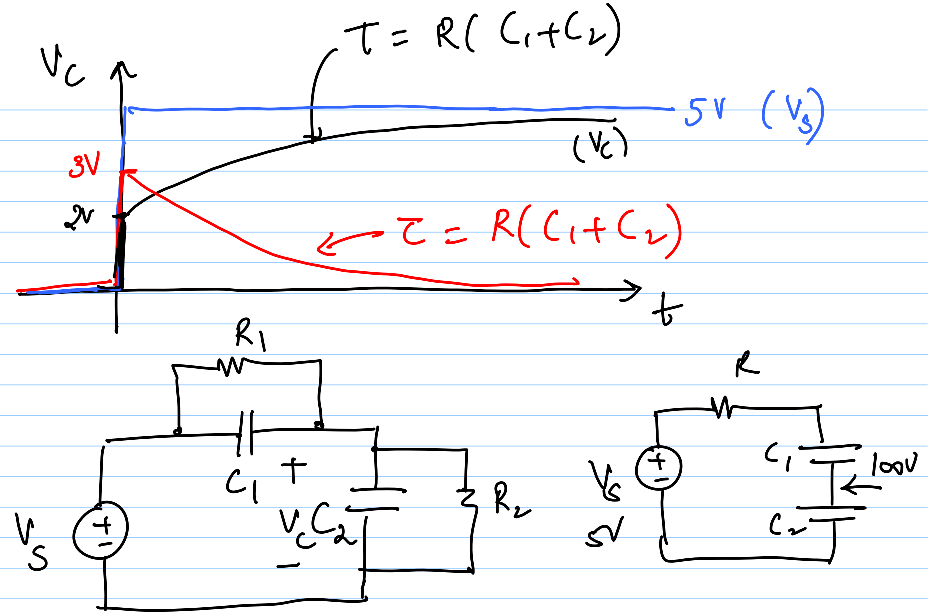
Charge conservation @ $t=0$

$$Q(t=0^-) = 0$$

$$C_2 V_c(0^+) + C_1(V_c(0^+) - V_s) = 0$$



$$V_c(0^+) = \frac{C_1}{C_1 + C_2} \cdot V_s = 2V$$



Step response of a 1st order ckt

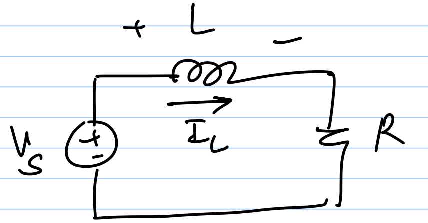
1) Determine time constant $\tau = R_{th} \cdot C_{eff.}$
   { Set sources to 0 }

2) Initial conditions + ckt analysis
   ⇒ V/I @ $t = 0^-$

3) At $t = 0^+$: determine any discontinuities in capacitor voltages @ $t = 0$
   - identify voltage source - cap. loops
   - open ckt Resistors & determine cap voltages

4) Determine values @ $t = \infty$
   - open ckt all capacitors

$$V_x = V_x(\infty) + \left[V_x(0^+) - V_x(\infty)\right]\exp\left(\frac{-t}{\tau}\right)$$



$$V_s - I_L \cdot R = L\frac{dI_L}{dt}$$

$$\frac{L}{R}\frac{dI_L}{dt} + I_L = \frac{V_s}{R}$$

$$\tau = \frac{L}{R}$$