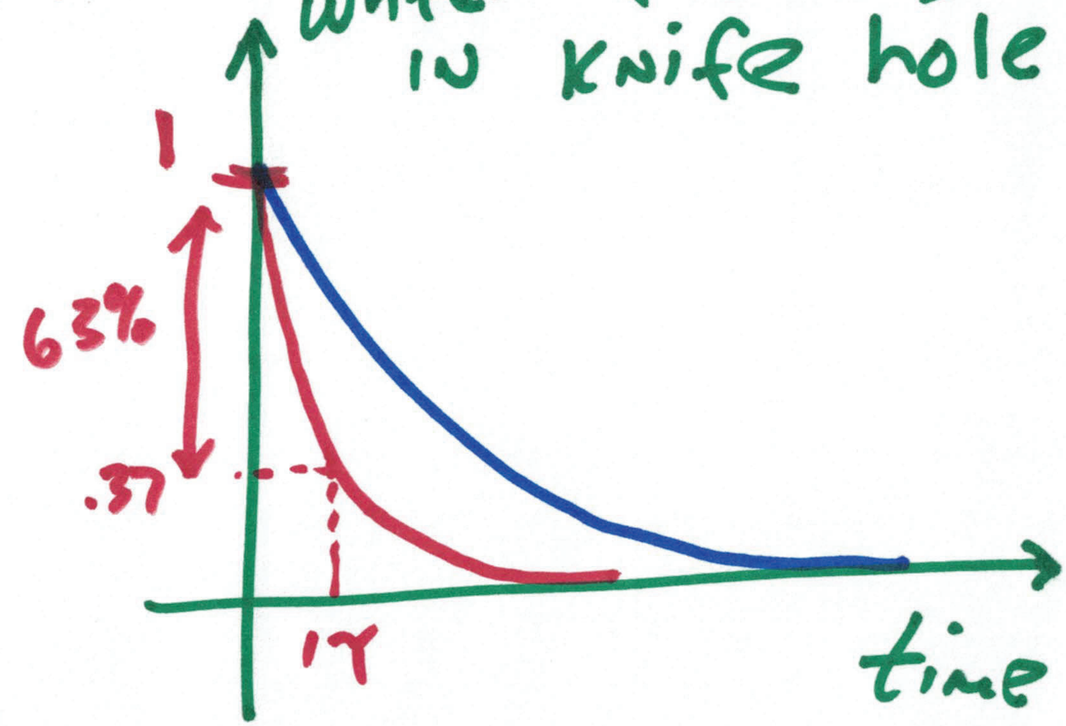
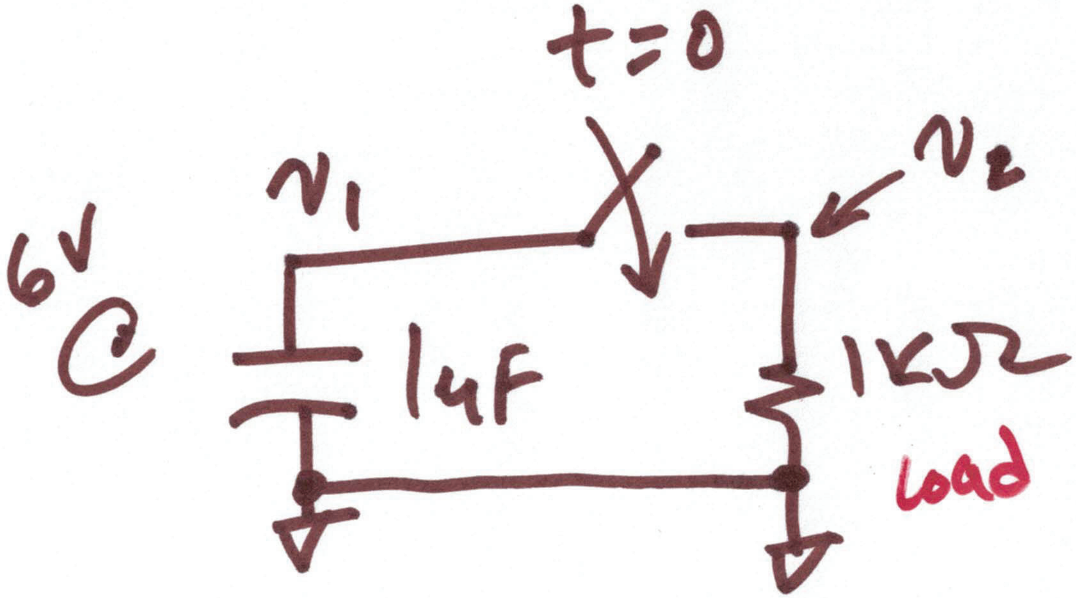
# EE 220 Circuits 1

# Oct. 18, 2021

# Lecture 15




Before switch closes

$v_2 = 0$

$v_1 = 6V$

$CV = Q$

$1\mu F \cdot 6V = 6\mu C$

Farad

coulombs

After switch closes

$v_i = 6V$

$v_f = 0$

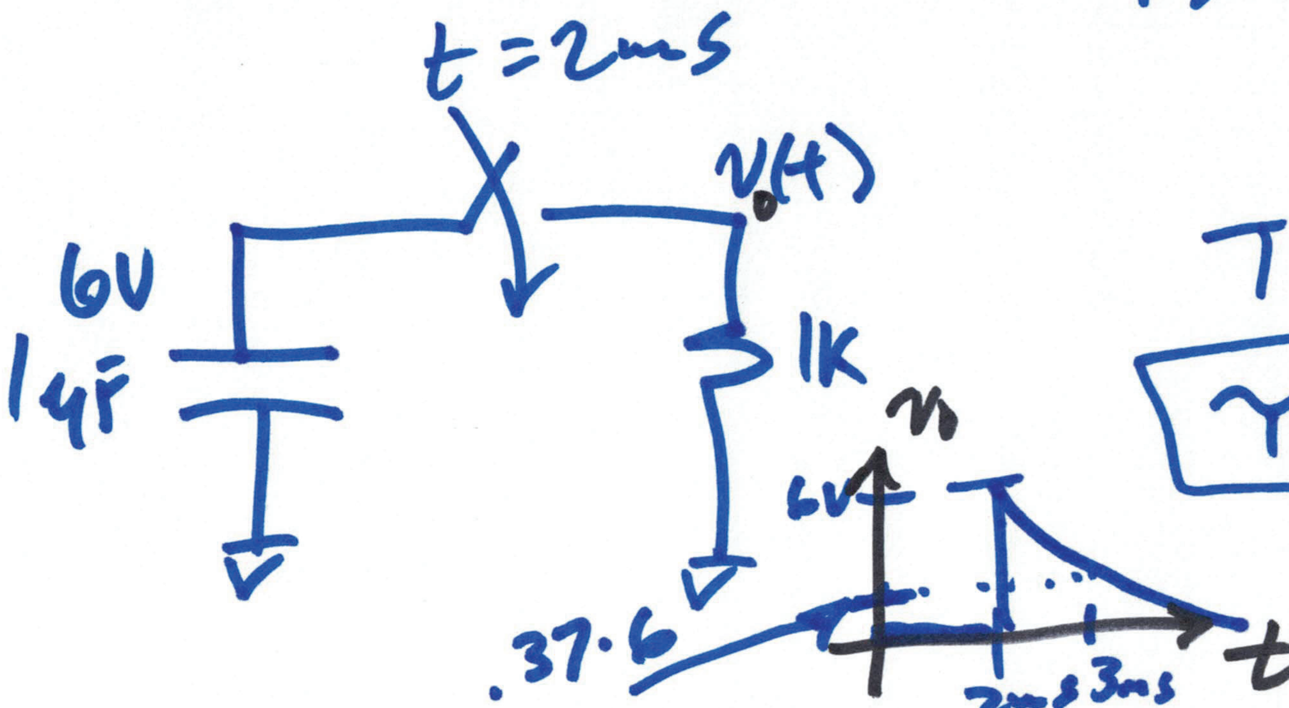
$v_1 = v_2$

$$v_2(t) = v_1(t) = v_f + (v_i - v_f)e^{-t/RC}$$

$\tau = RC$ (seconds)

$$v_1(t) = 6e^{-t/RC}$$

$$v(t) = v_f + (v_i - v_f)e^{-t/RC}$$




$T = 1K \cdot 1\mu$

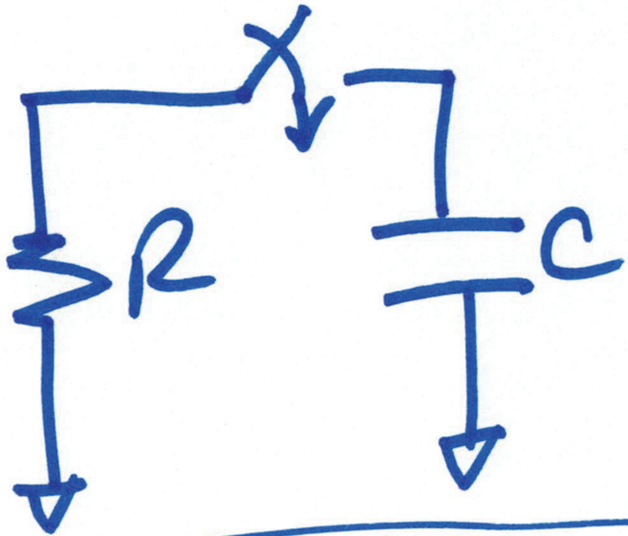
$\tau = 1ms$

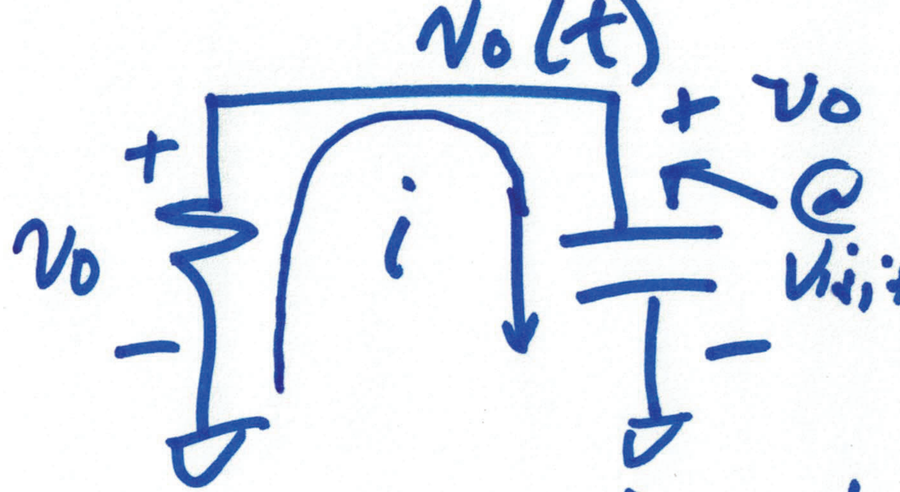
$v_o(t) = 0 \quad t \leq 2ms$

$$v_o(t) = 6e^{\frac{-(t-2ms)}{1ms}} \quad t \geq 2ms$$

$$\frac{-(t-2ms)}{1ms}$$

RC → 1ms




$$i = C\frac{dv_0}{dt}$$

BOUNDARY CONDITIONS

$$v_0(0) = V_{init}$$

$$v_0(\infty) = 0$$

$$v_0(t) = -i \cdot R$$


$$v_0(t) = -RC\frac{dv_0(t)}{dt} \rightarrow \int_0^t \frac{dt}{-RC} = \int_{V_{init}}^{v_0} \frac{dv_0}{v_0}$$

$$-\frac{t}{RC} = \ln x \Big|_{V_{init}}^{v_0}$$

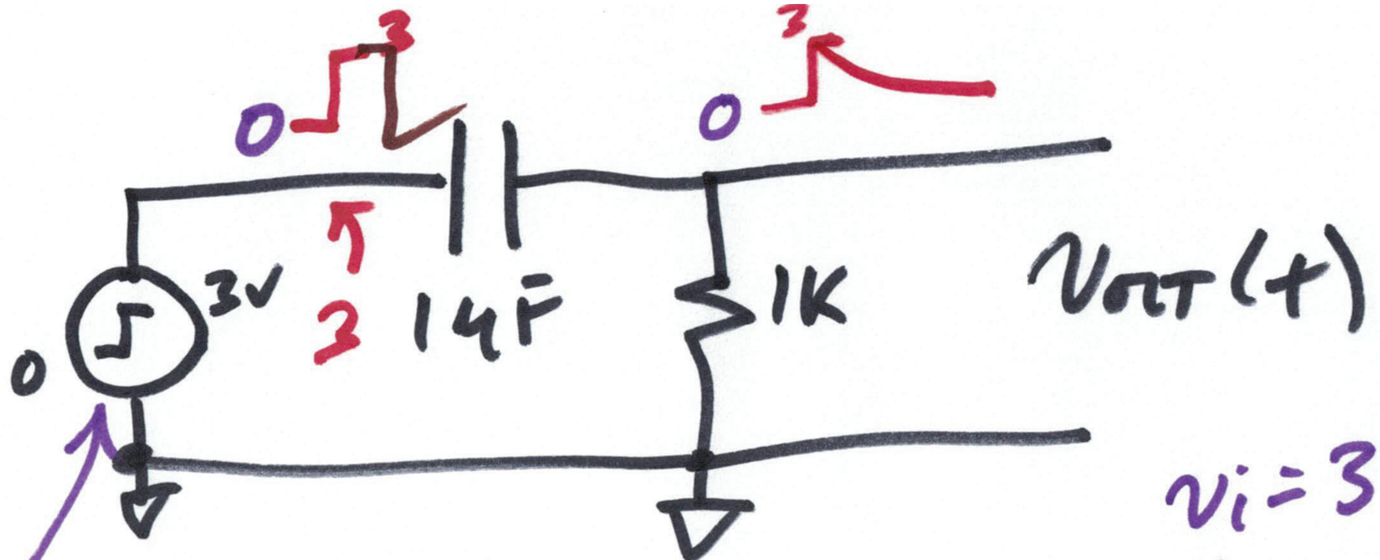
$$-\frac{t}{RC} = \ln v_o(t) - \ln V_{init}$$

$$-\frac{t}{RC} = \ln \frac{v_o(t)}{V_{init}}$$

$$e^{-\frac{t}{RC}} \quad e$$

$$e^{-t/RC} = \frac{v_o(t)}{V_{init}}$$

$$v_o(t) = V_{init}\, e^{-t/RC}$$




pulse from 0 to 3

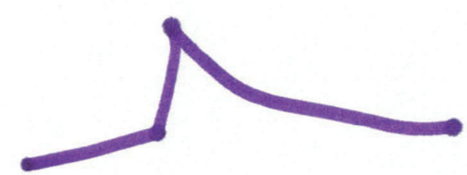
$v_i = 3V$

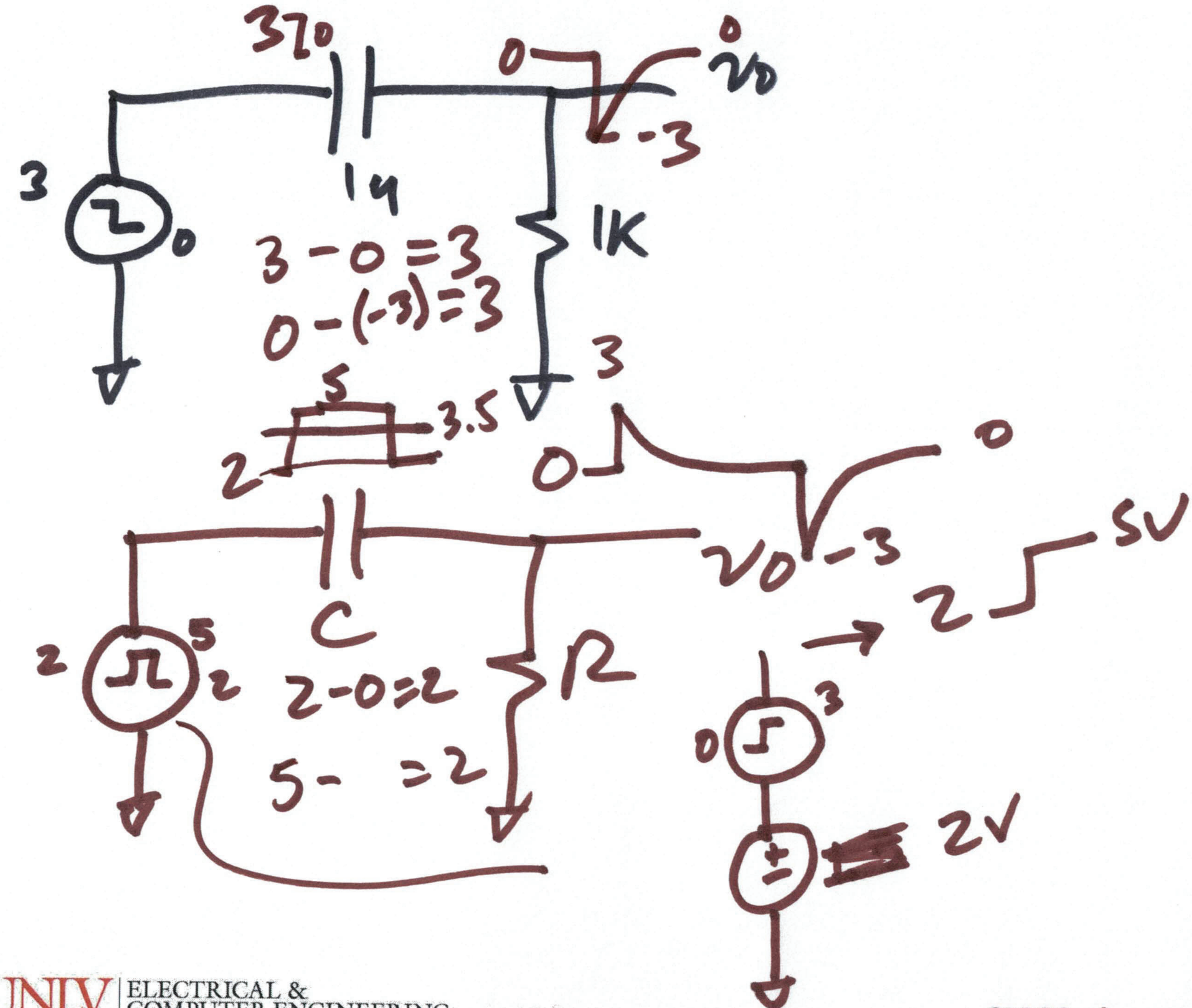
$v_f = 0$

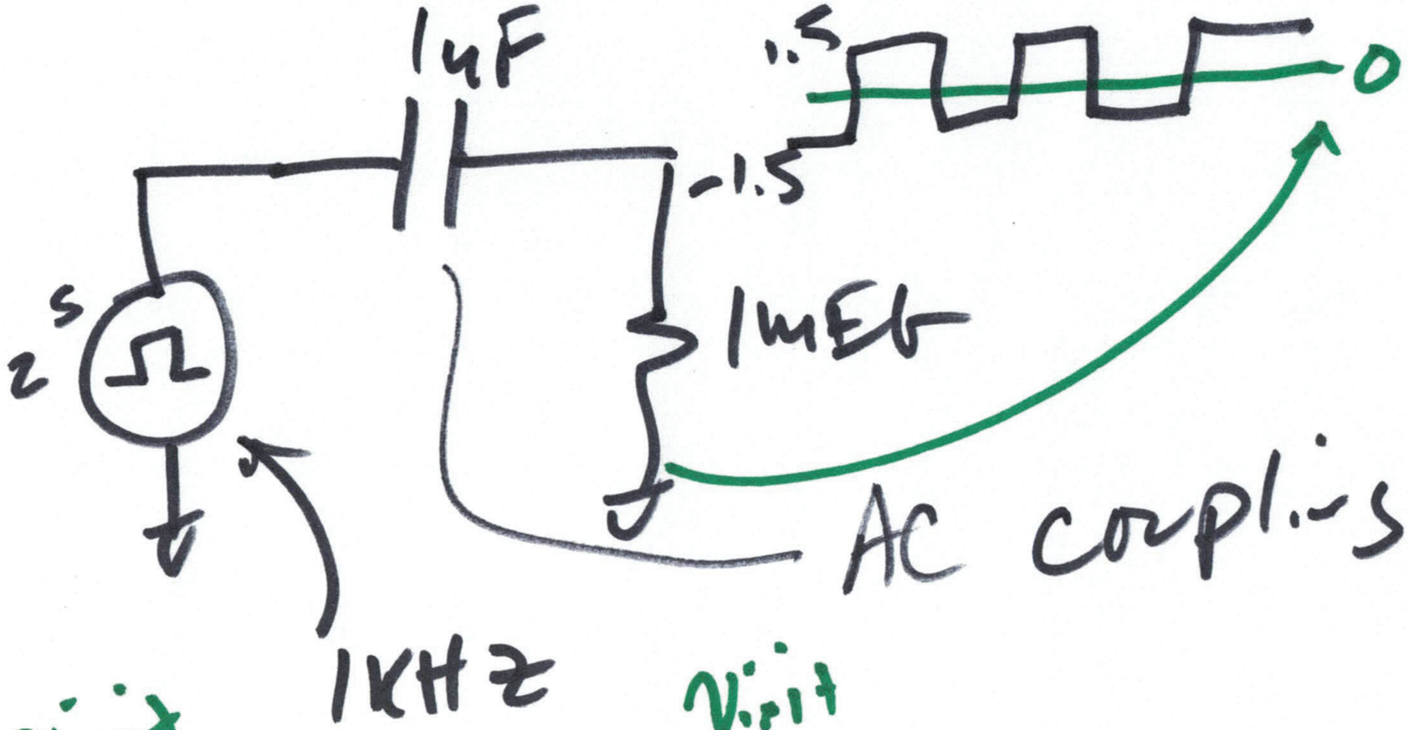
$$v = v_f + (v_i - v_f)e^{-t/RC}$$

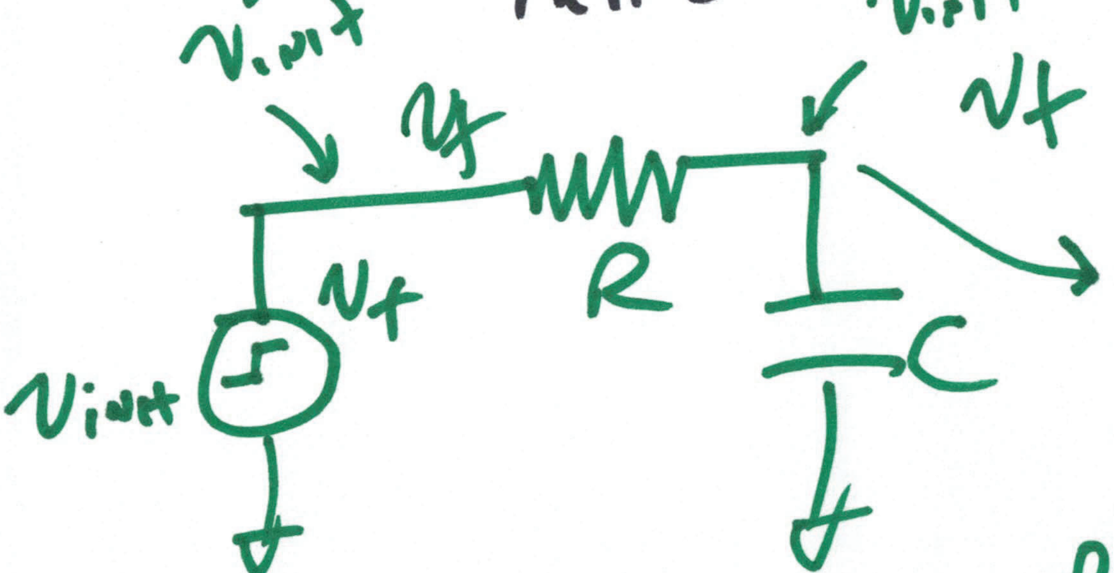
$$= 3e^{-t/RC}$$


step function




3τ0
0
20
-3
3
0
1μ
1K
3 − 0 = 3
0 − (−3) = 3
3
5
3.5
2
0
0
20
-3
5V
2
2
5
2
C
R
2 − 0 = 2
5 − = 2
0
3
2V




$$v_o = v_f + (v_{init} - v_f)e^{-t/RC}$$

pick up here on wednesday