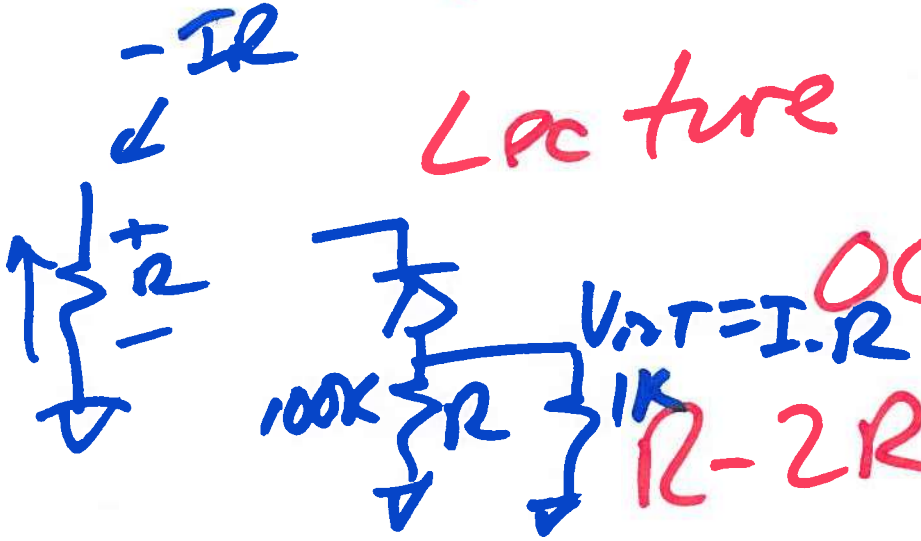
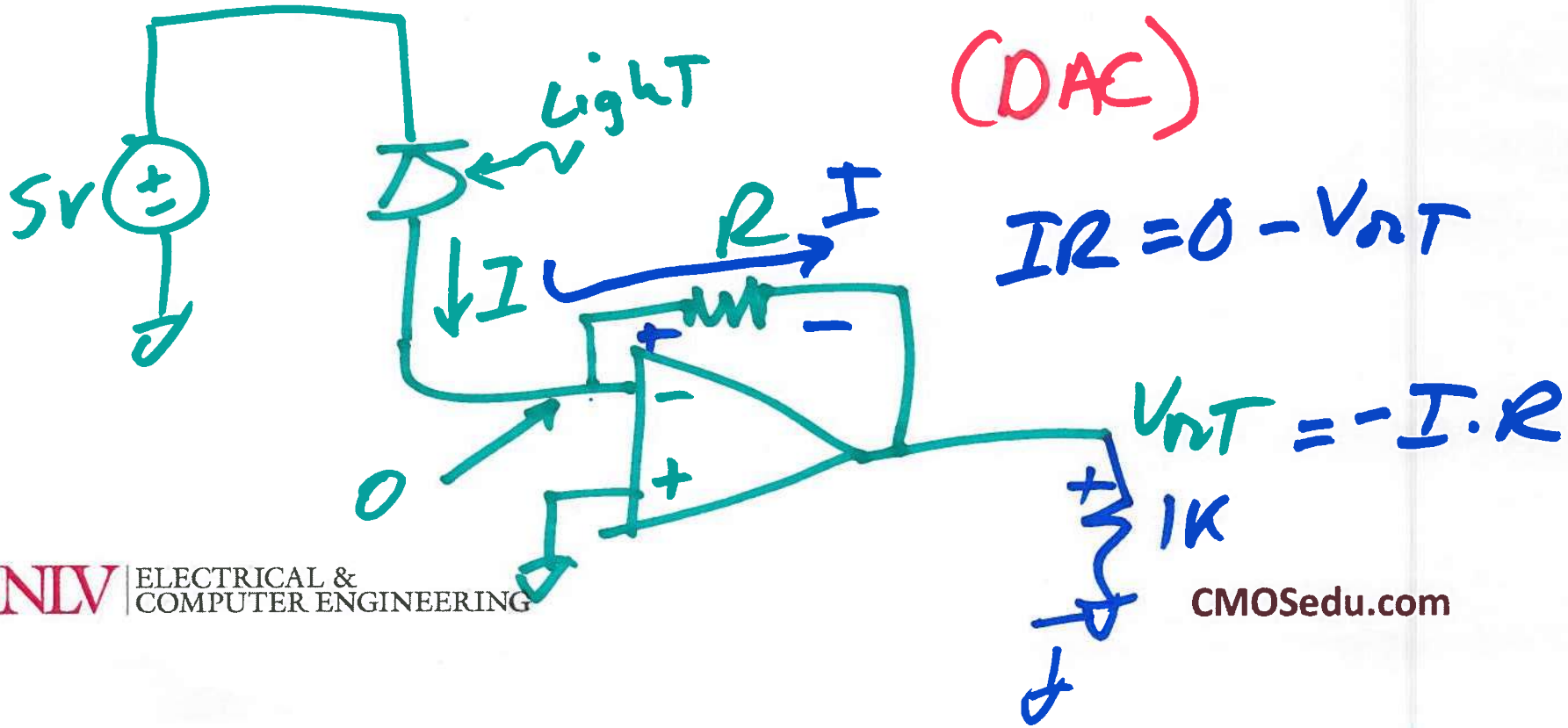
# EE 220 Circuits 1

## Lecture 15

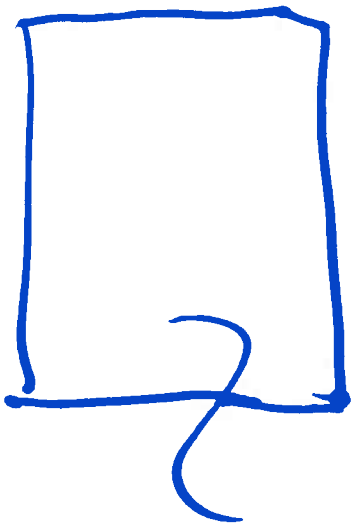
OCT. 17, 2018




## R-2R Digital-to-Analog Converter (DAC)



# Capacitors



Capacitive touch


$$\frac{\epsilon \cdot A}{t} = C$$

FARADS

micro

$1\mu F = 10^{-6} F$

$1nF = 10^{-9} F$

nano

$1pF = 10^{-12} F$

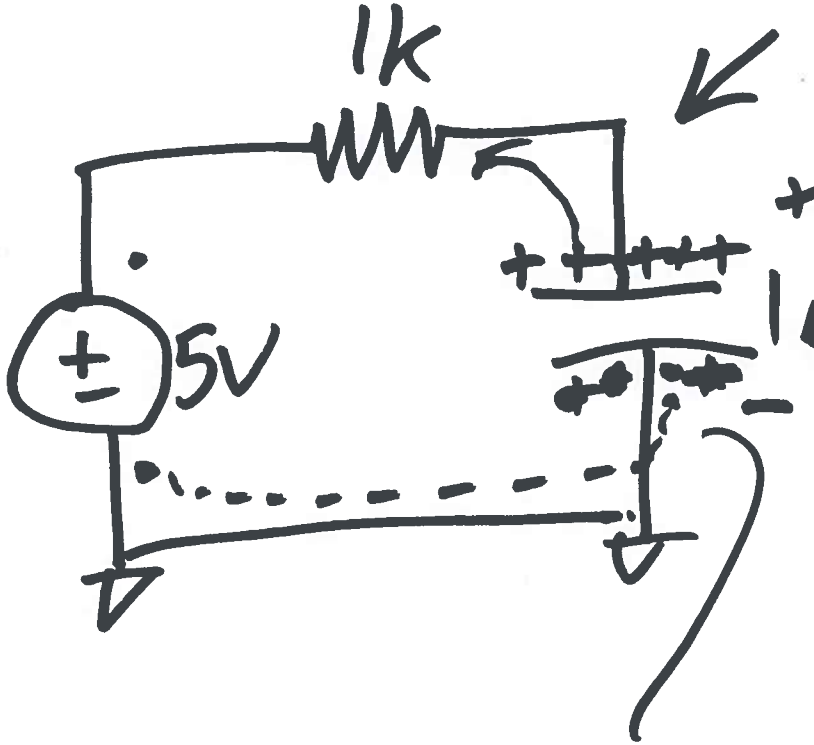
pico

$1fF = 10^{-15} F$

femto

$1aF = 10^{-18}$

atto




current flows in a cap is displacement current

coulombs

$Q = C \cdot V$ ← voltage

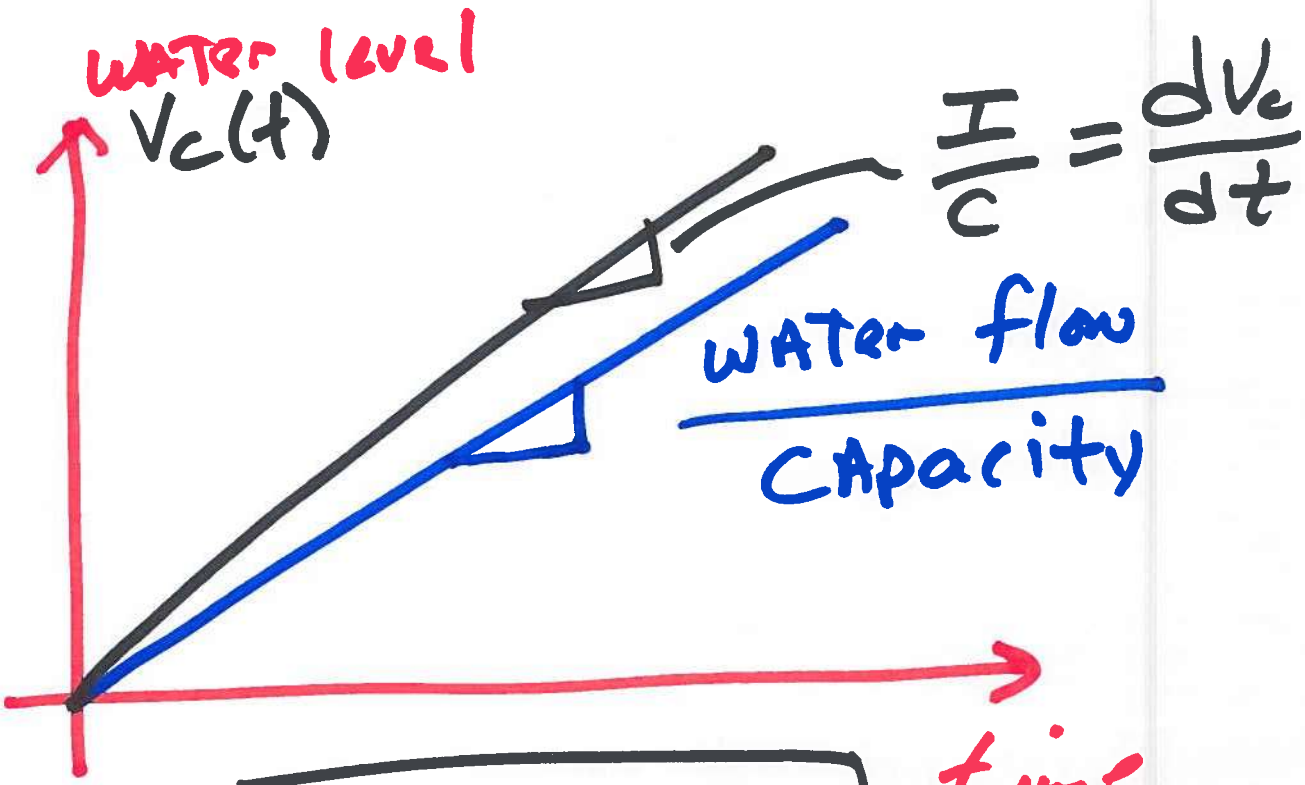
capacitance (FARADS)

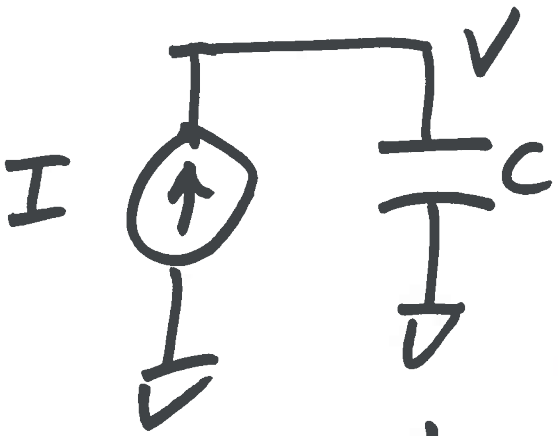
$Q = 1\mu F \cdot 5V$

$= 5\mu C$

$CV = Q$

Replacing a Run Capacitor

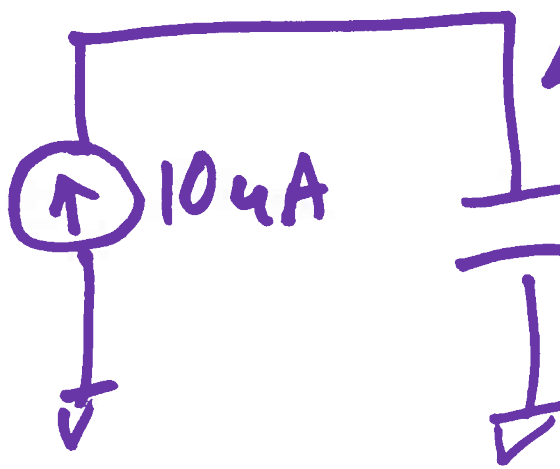




$$V_c = \frac{1}{C}\int_0^t I \cdot dT$$

$$I = C \cdot \frac{dV_c}{dt}$$

plot the voltage assuming




$V_c(0) = 0$

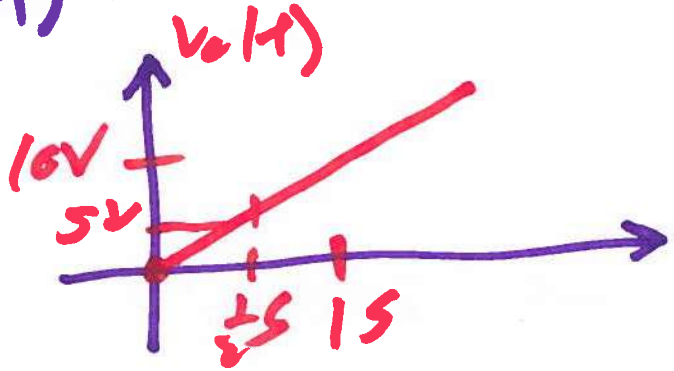
$$V = \frac{1}{C}\int i \cdot dT$$

$$V_c(t) = \frac{1}{C}\int_0^t 10\mu A \cdot dt$$

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

$$V_c(t) = 10 \cdot t \text{ volts}$$

$$\text{CONST} = \frac{i}{C} = \frac{dv}{dt}$$



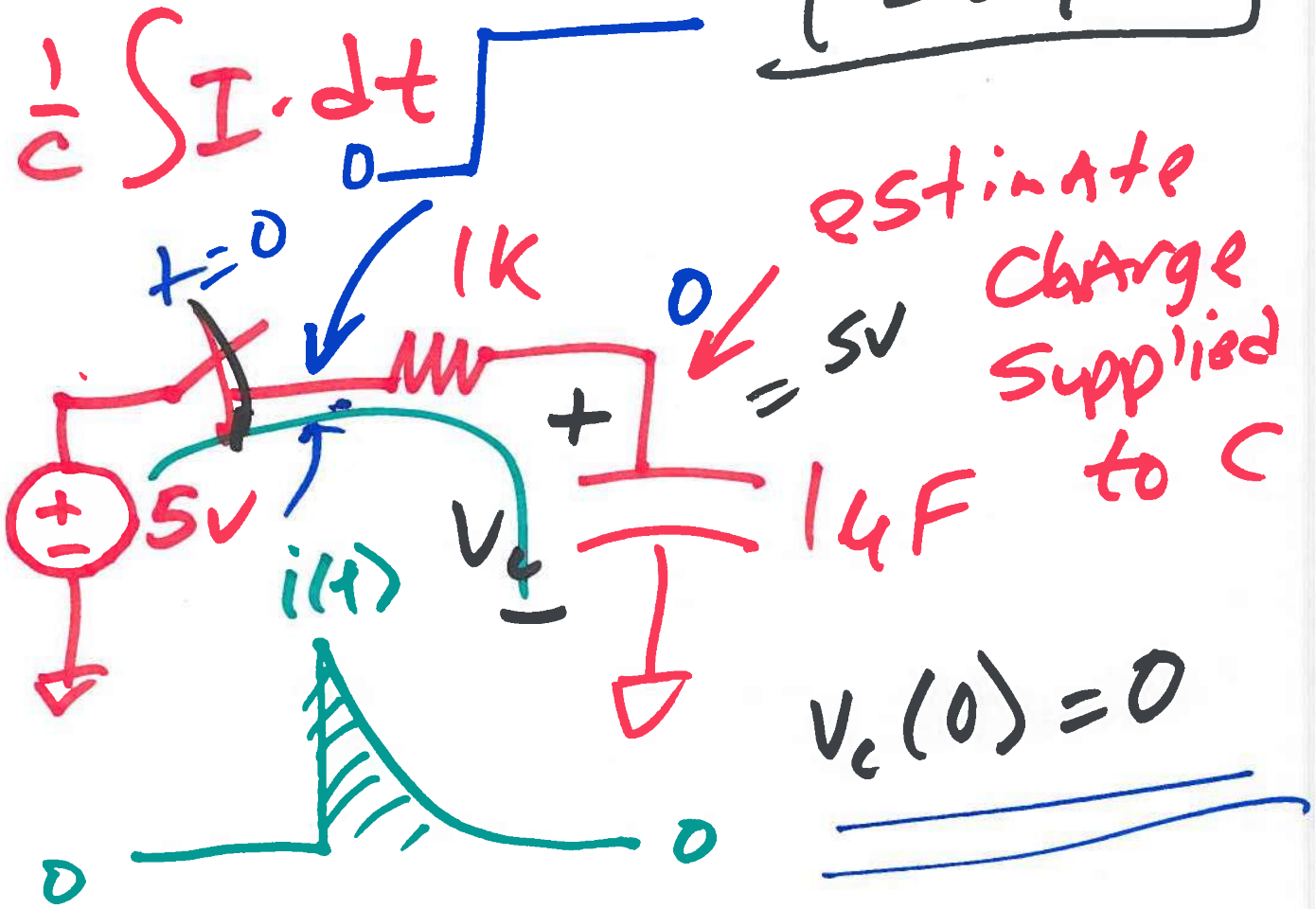
$CV = Q$ ←

$I = C\frac{dv_c}{dt}$

$Q = 5 \cdot 1\mu F$

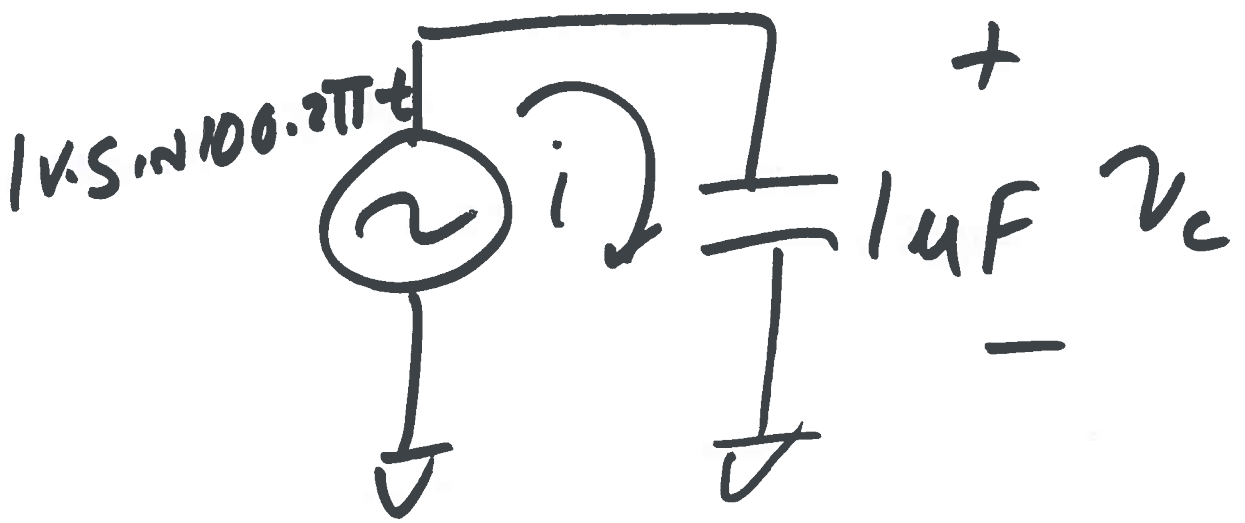
$= 5\mu C$

$v_c = \frac{1}{C}\int I \cdot dt$




estimate charge supplied to C

$v_c(0) = 0$




$$\frac{10^{-6}}{10^{2}} = 10^{-8}$$

$$\frac{1}{2\pi} = .159$$

$$.159 \cdot 10^{-8}$$

$$15.9 \cdot 10^{-9}$$

$$15.9\,nA$$

$$v_c(t) = 1 \cdot \sin(2\pi 100 \cdot t)$$

$$i = 1\mu F \cdot \frac{d \sin 2\pi 100 \cdot t}{dt}$$

$$6.28 \cdot 10^{2} \cdot 10^{-6} \quad 2\pi 100$$

$$6.28 \cdot 10^{-4}$$

$$i = 10^{-6} \cdot \cos 2\pi \cdot 100 \cdot t$$

$$6.28\,mA$$

$$\frac{}{2\pi 100}$$

7)