EE 220 circuits I

Lecture 14

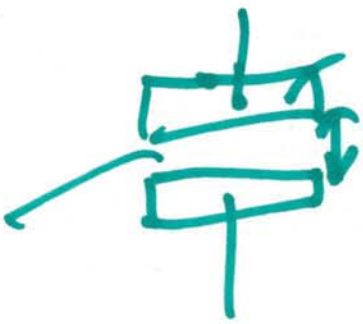
$$I = V \cdot \frac{1}{R} \qquad \frac{I}{V} = \frac{1}{R}$$

$\frac{1}{R}$ — Conductance, MHOS

$\frac{I}{V}$ — transconductance Amp.

Capacitors

(formerly known as a condenser)



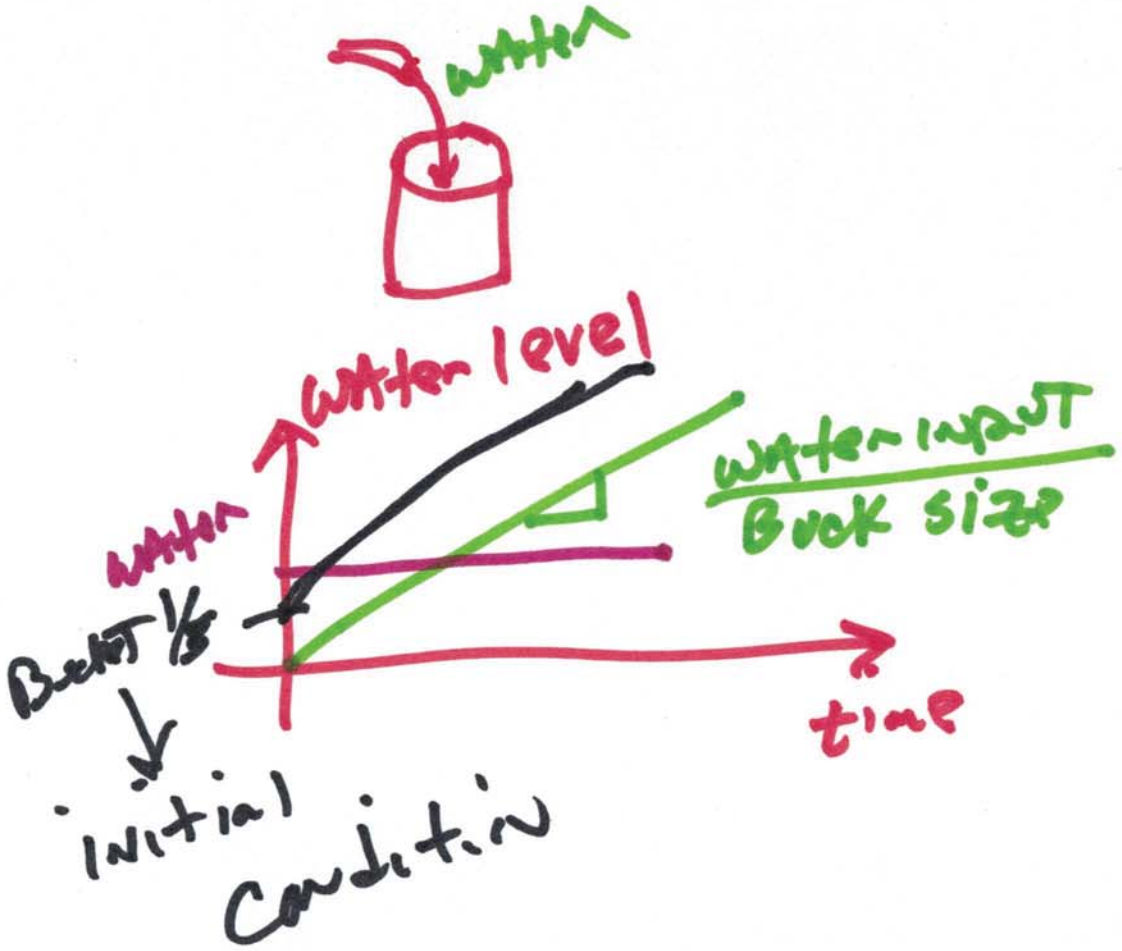
inductor

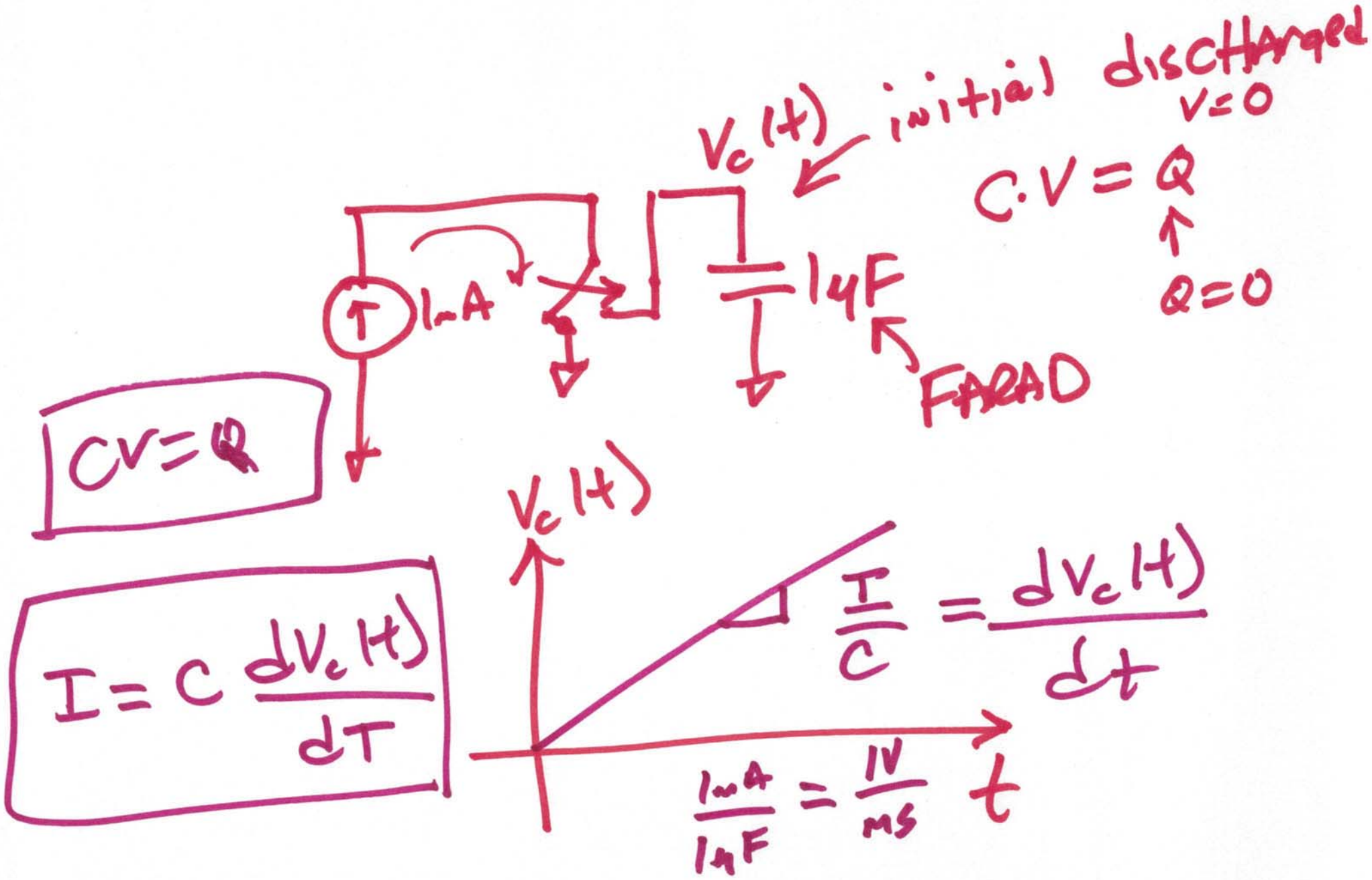
$$C = \frac{A \cdot \epsilon}{t}$$

ϵ ← dielectric constant

C ← capacitance

8.85×10^{-18} F/μm


water
water level
water
Bucket is
initial
Condition
water input
Bucket size
time


initial discharged
V=0
$V_c(t)$
$C \cdot V = Q$
$Q = 0$
1mA
1μF
FARAD
$CV = Q$
$I = C \frac{dV_c(t)}{dT}$
$V_c(t)$
$\frac{I}{C} = \frac{dV_c(t)}{dt}$
$\frac{1mA}{1\mu F} = \frac{1V}{ms}$
t

water

$-t/RC$

W_{peak}

size of Bucket

diameter of hole in valve

time

$-t/RC$

charged to V_p

$v_c(t)$

$t=0$

$v_R(t)$

C

R

$v_c(t)$

V_p

$\frac{V_p}{R}$

"electron Boom"

$\frac{+}{-}\ 1 \uparrow I = -C\frac{dv}{dt}$

$I \downarrow \lessgtr^{+}_{R}\ V = IR$

$CV = Q$

$I \downarrow \dashv\vdash^{+}_{-}\ V$

Super maker Tator

$I = C\frac{dV}{dT_{V_f}}$

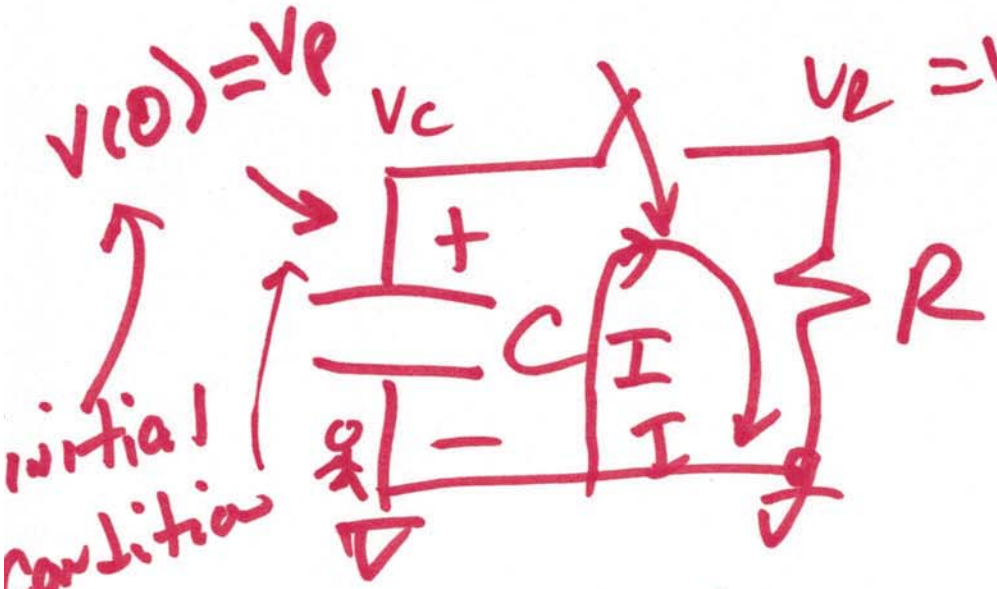
$V_c(t) = \frac{1}{C}\int I \cdot dt$

V_{in}

CMOSedu.com

UNLV | ELECTRICAL & COMPUTER ENGINEERING

5)



$V_L = V_C$ (after switch closes)

$$I = -C\frac{dV_C}{dt}$$

first-order differential Eqn.

$$V_C - IR = 0$$

$$V_C + RC \cdot \frac{dV_C}{dt} = 0$$

separation of VARIABLES

$$V_C = -RC \cdot \frac{dV_C}{dt}$$

$$-t/RC = \int_0^t \frac{dt}{RC} = \int_{V_{init}}^{V_f} \frac{dV_C}{V_C} = \ln V_f - \ln V_{init}$$

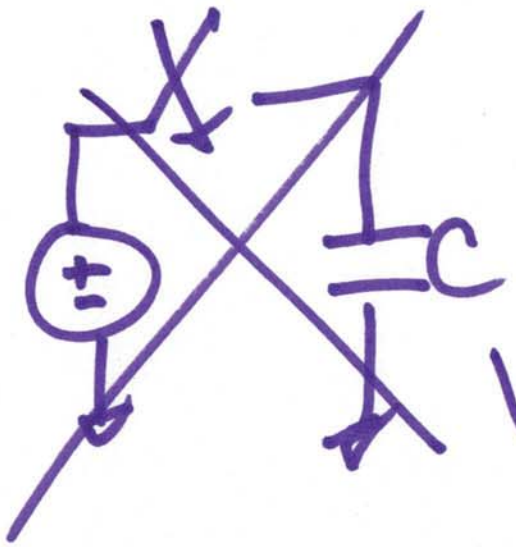
$\ln \frac{V_f}{V_{init}}$

$$\frac{t}{RC} = \ln \frac{V_t}{V_{init}}$$

Cannot instantaneously change a cap

$$e \qquad e$$

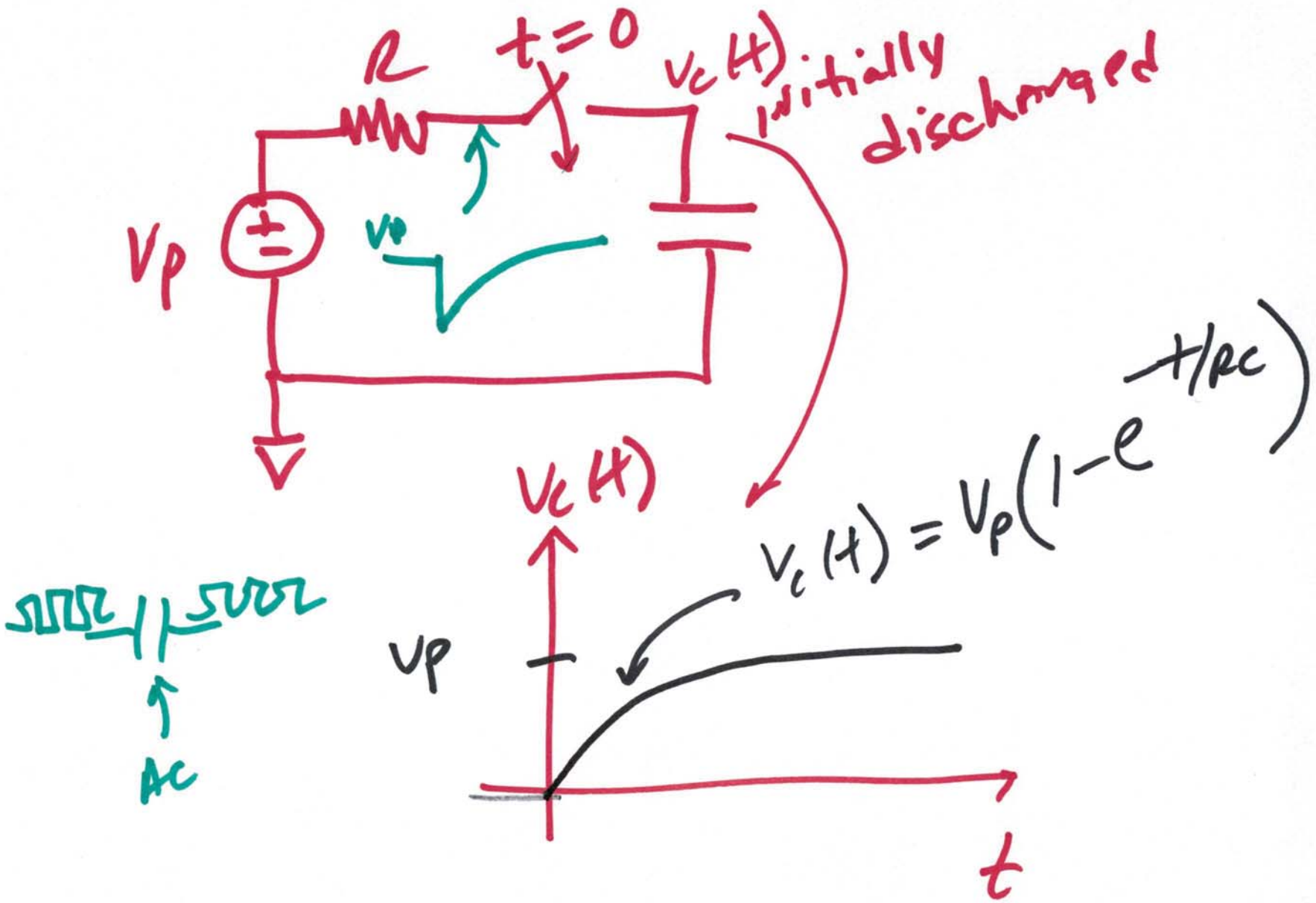
$$e^{-t/RC} = \frac{V_t(t)}{V_{init}}$$



$$V_c(t) = V_{init} \cdot e^{-t/RC}$$

V_p

$$V_c(t) = V_p e^{-t/RC}$$



b)