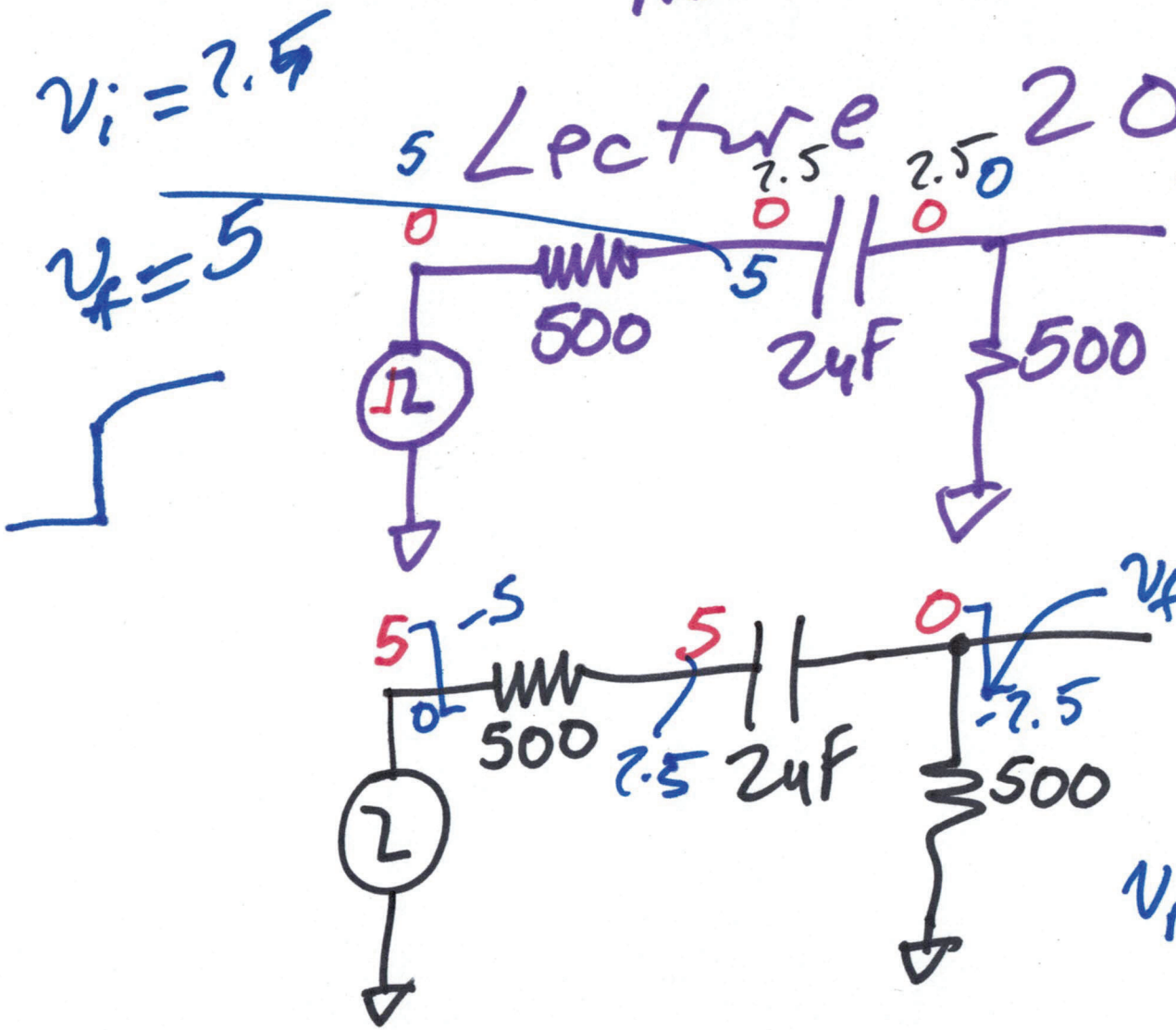
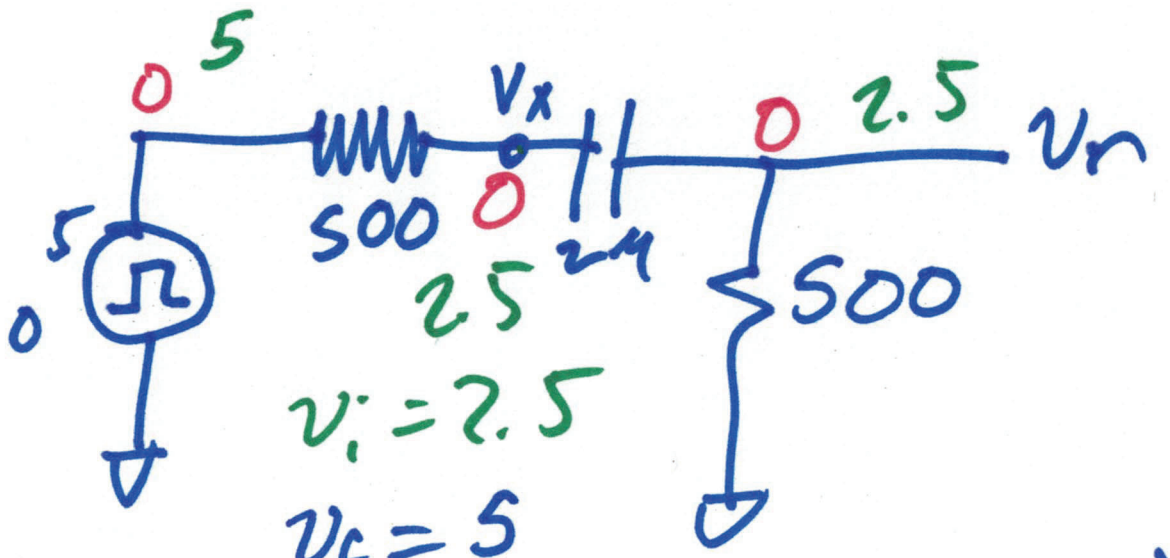
EE 220 circuits I

NOVEMBER 8, 2023

Lecture 20





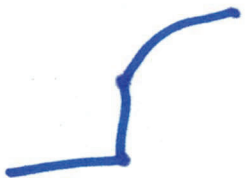
$v_i = 2.5$

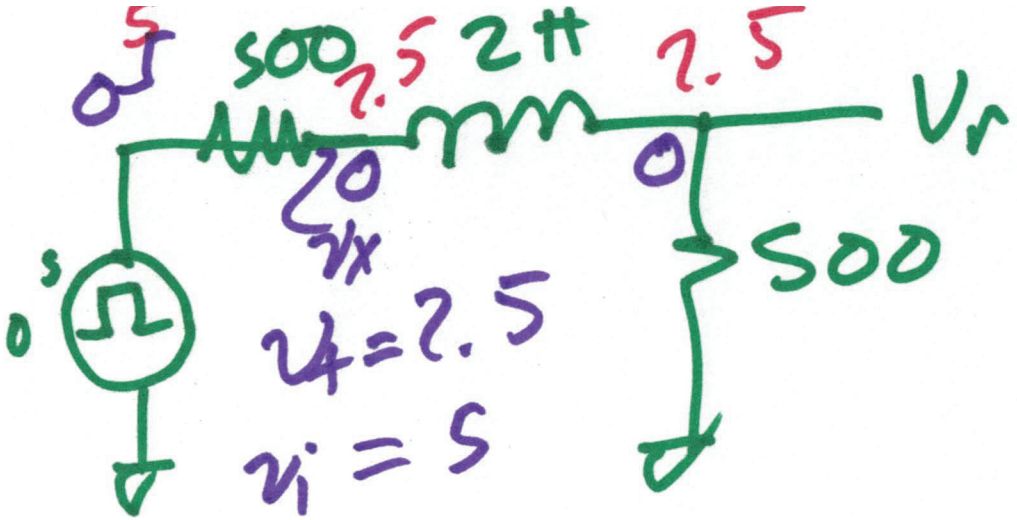
$v_f = 5$

$$v_x(t) = 5 + (2.5-5)e^{-\frac{(t-1ms)}{2ms}}$$

$v_x(1ms) = 2.5$

$v_x(\infty) = 5V$





$v_i = 0$

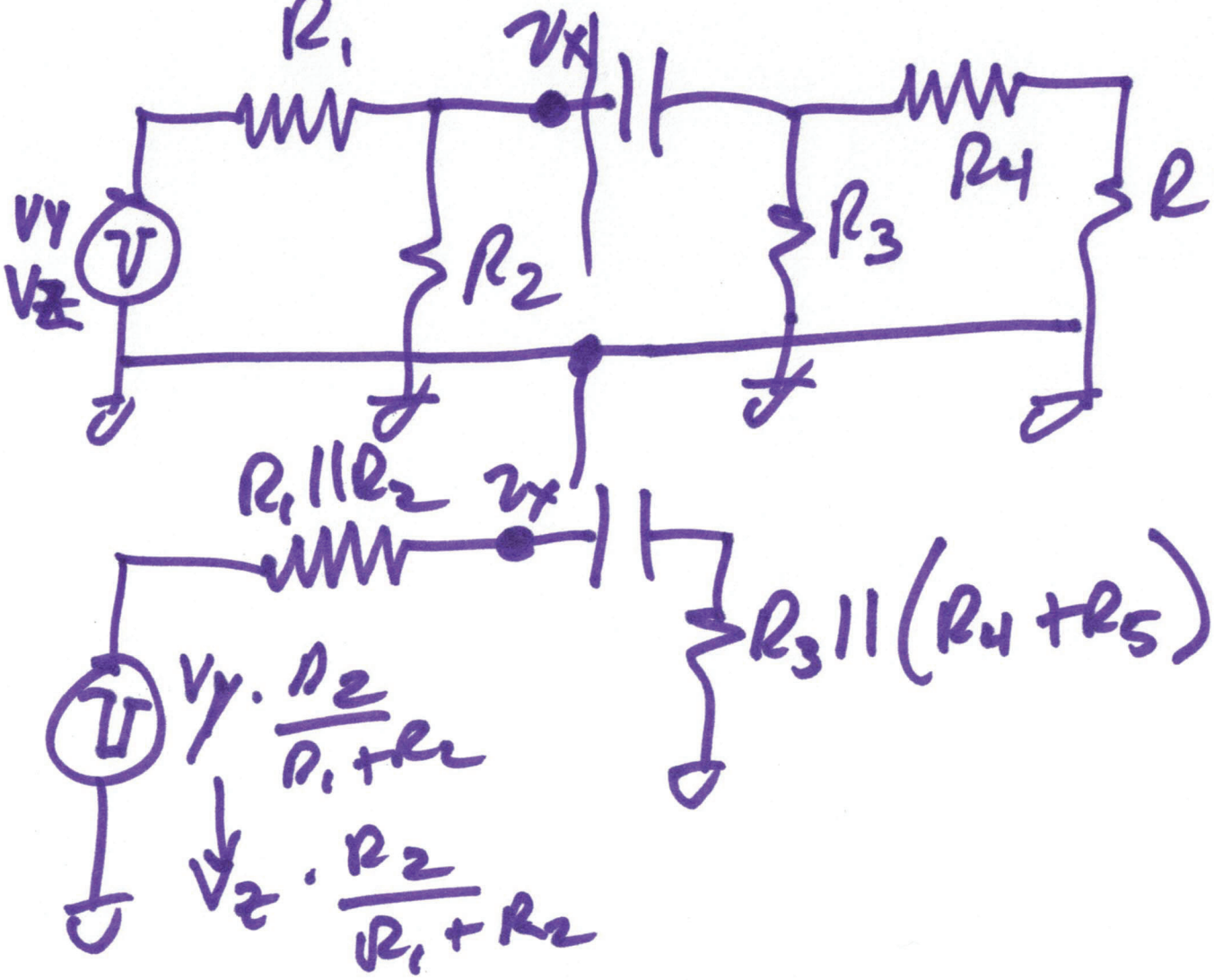
$v_f = 2.5$

$v_x(t) = 2.5 + (5-2.5)e^{-\frac{t}{2ms}}$

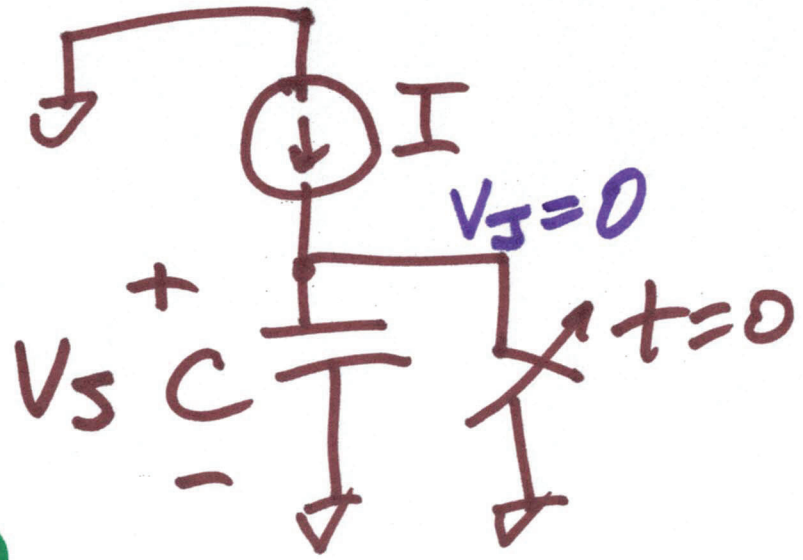
$v_x(t) = 2.5 + (0-2.5)e^{-\frac{(t-1ms)}{2ms}}$

$2.5 + (2.5)e^{-\frac{(t-1ms)}{2ms}}$

$2.5\left(1 - e^{-\frac{(t-1ms)}{2ms}}\right)$


R1
Vx
R4
R5
R3
R2
Vy
Vz
R1||R2
Vx
R3||(R4+R5)
Vy · R2/(R1+R2)
Vz · R2/(R1+R2)

Integrators

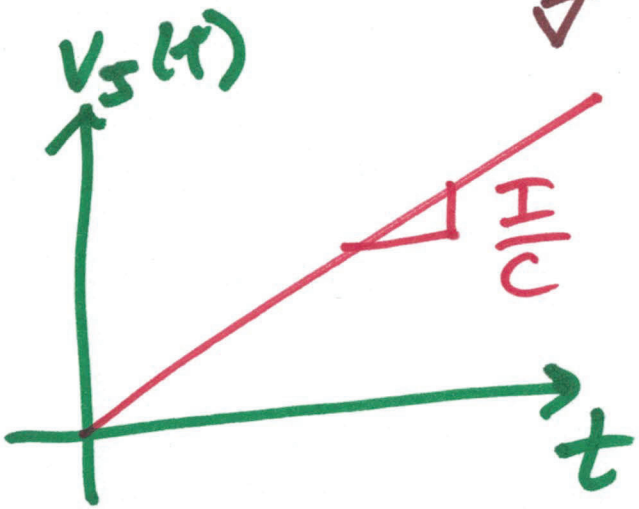


switch closed
$t < 0$

switch open
$t > 0$

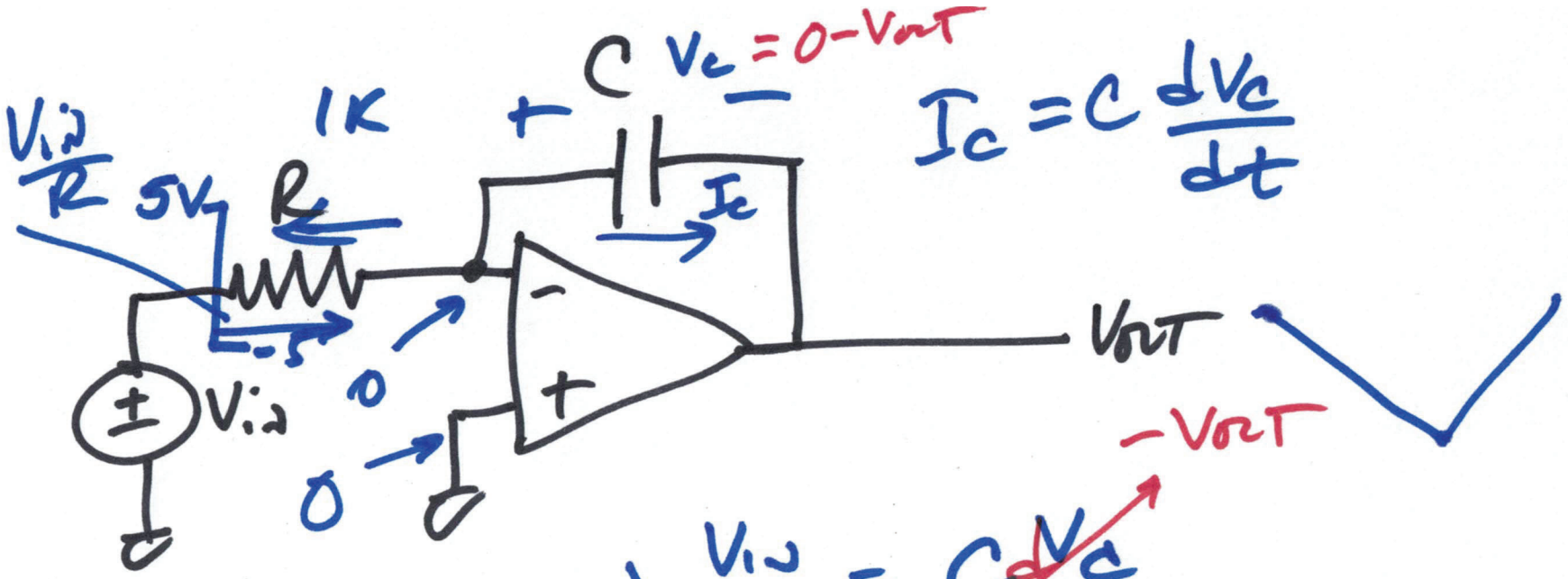
$$I = C\frac{dV}{dt}$$

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



$$\int_0^{v_S(t)} dV_J = \int_0^t \frac{I}{C}\,dt$$

$$v_J(t) = \frac{I}{C} \cdot t$$



$$I_c = C\frac{dV_c}{dt}$$

5V
-5
1μF
1K

$$\frac{V_{in}}{R} = C\frac{dV_c}{dt}$$

$$\int_0^{V_{OUT}(t)} dV_c = \frac{1}{RC}\int_0^t V_{in}\cdot dt$$

$$V_{OUT} = -\frac{1}{RC}\int_0^t V_{in}\cdot dt$$

$$V_{OUT}(t) = -\frac{1}{RC}\cdot V_{in}\cdot t$$

$$= -\frac{1}{C}\cdot\frac{V_{in}}{R}\cdot t$$

$$V_{OUT} = \frac{-5}{1K\cdot 1\mu}\cdot t$$

$$= -\frac{5V}{ms}\cdot t$$