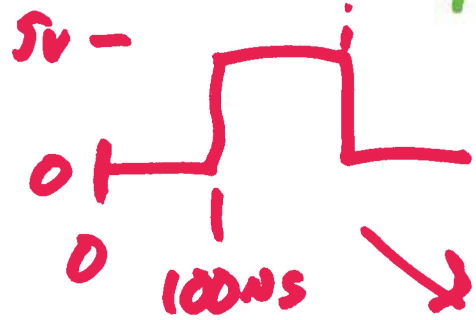
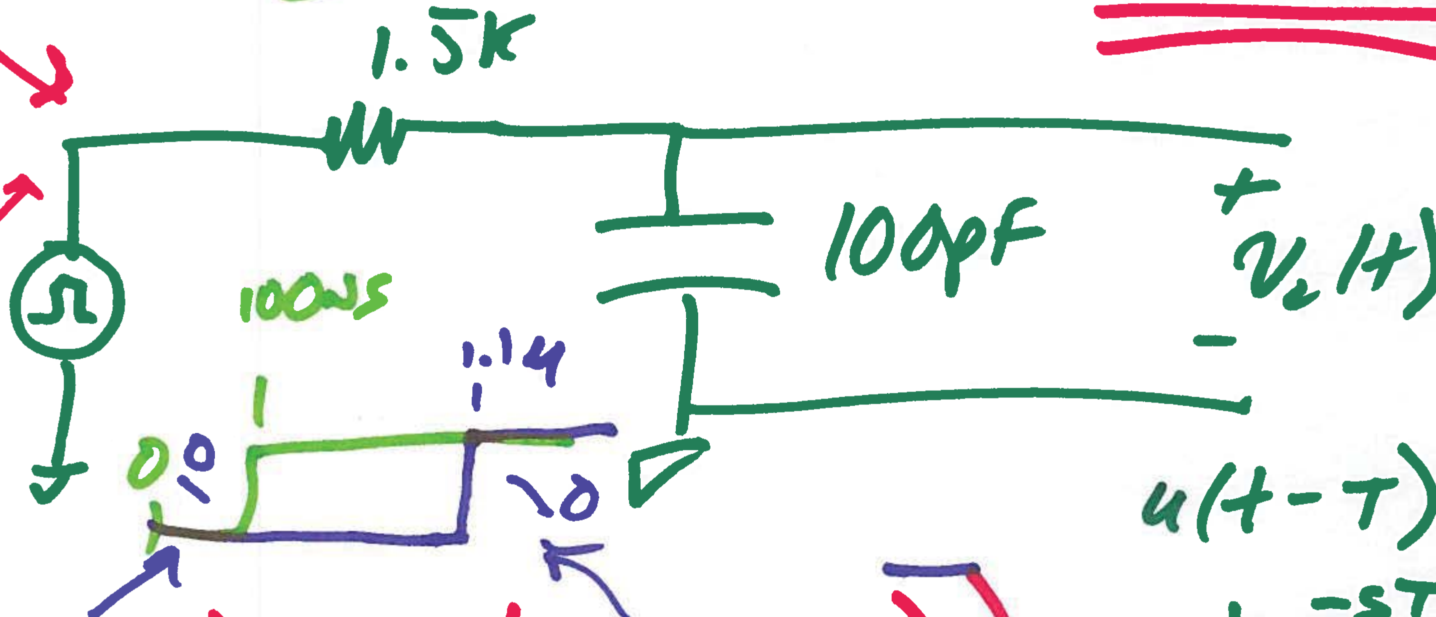
EE 221
Circuits II
April 8, 2019
Lecture 18

$T = 150\,ns$





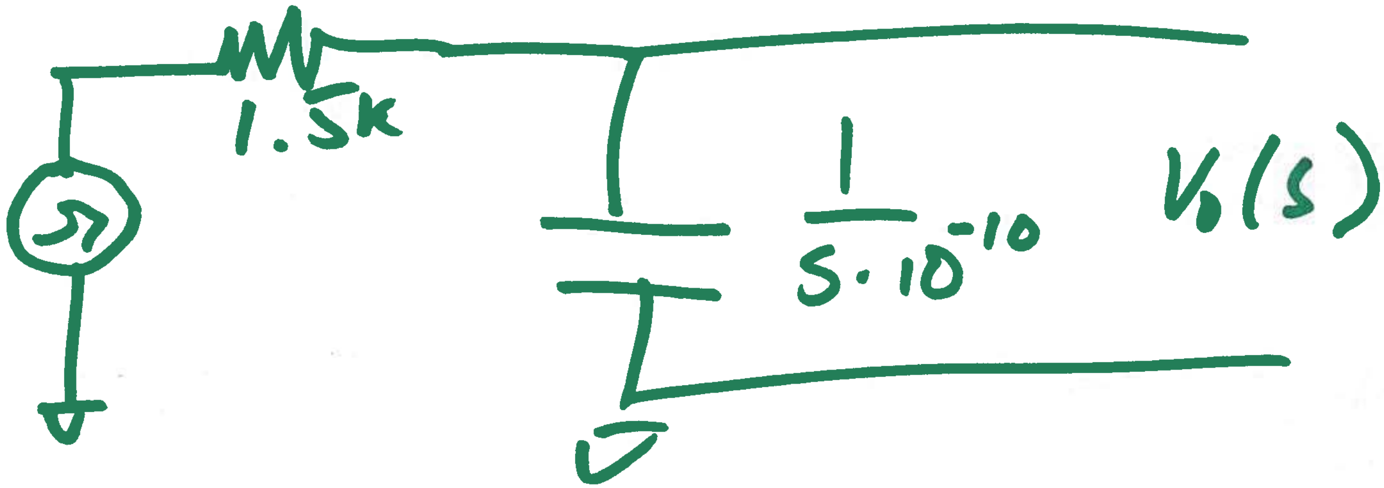
$u(t-T)$

$\frac{1}{s}e^{-sT}$

$5\left(u(t-100ns) - u(t-1.1\mu s)\right)$

$\frac{5}{s}e^{-100n\cdot s} - \frac{5}{s}e^{-1.1\mu\cdot s}$

$$\frac{5}{s}e^{-s\cdot 100n} - \frac{5}{s}e^{-s\cdot 1.1\mu}$$



$$V_o(s) = \left(\frac{5}{s}e^{-s\cdot 100n} - \frac{5}{s}e^{-s\, 1.1\mu}\right)\cdot \frac{\frac{1}{s\cdot 10^{-10}}}{\frac{1}{s\cdot 10^{-10}} + 1.5K}$$

2)

$$V_o(s) = \frac{5}{s}\,\frac{e^{-s\cdot 100n}}{1+s\cdot 1.5\cdot 10^{-7}} - \frac{\frac{5}{s}\,e^{-s\cdot 1.1\mu}}{1+s\cdot 1.5\cdot 10^{-7}}$$

$$= \frac{5}{150n\cdot s}\left(\frac{e^{-s\cdot 100n}}{\left(s+\frac{1}{150ns}\right)} - \frac{e^{-s\,1.1\mu}}{s+\frac{1}{150ns}}\right)$$

$$= \frac{5}{s\cdot 150n}\left(\frac{e^{-s\cdot 100n}-e^{-s\,1.1\mu}}{s+\frac{1}{150n}}\right)$$

$$\overset{?}{=} \frac{A}{s} + \frac{B}{s+\frac{1}{150n}}$$

$$\mathcal{L}\{f(t)\} = \int_{0^-}^{\infty} f(t) e^{-st} \cdot dt$$

$$f(t) = f_1(t) + f_2(t)$$

$$\mathcal{L}\{f(t)\} = \int_{0^-}^{\infty} f_1(t) e^{-st} \cdot dt \quad +$$

$$\int_{0^-}^{\infty} f_2(t) e^{-st} \cdot dt$$

$$F(s) = F_1(s) + F_2(s)$$

$$\frac{X}{s}\,\frac{e^{-sT}}{s+\frac{1}{Y}} = V(s)$$

$$s = -\frac{1}{Y}$$

$$\cancel{s}\left(\frac{X}{\cancel{s}}\cdot\frac{e^{-sT}}{\cancel{s+\frac{1}{Y}}}\right) = \cancel{s+1/Y}\left(\frac{\cancel{A}}{\cancel{s}} \overset{0}{} + \frac{B}{\cancel{s+\frac{1}{Y}}}\,\cancel{s}\overset{0}{}\right)$$

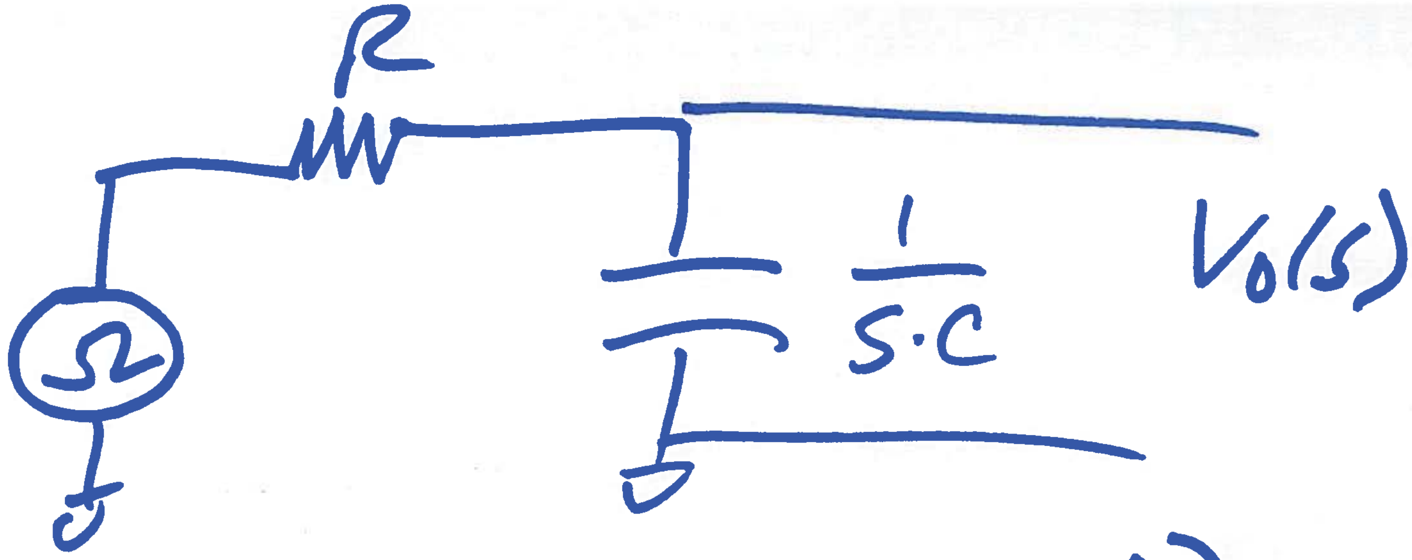
$$A = \frac{X}{1/Y} = X\cdot Y$$

$$B = \frac{X}{-\frac{1}{Y}}\cdot e^{+\frac{T}{Y}}$$

$$V(s) = \frac{X}{1/\gamma} \cdot \frac{1}{s} + \frac{X}{-\frac{1}{\gamma}} e^{T/\gamma} \frac{1}{s + \frac{1}{\gamma}}$$

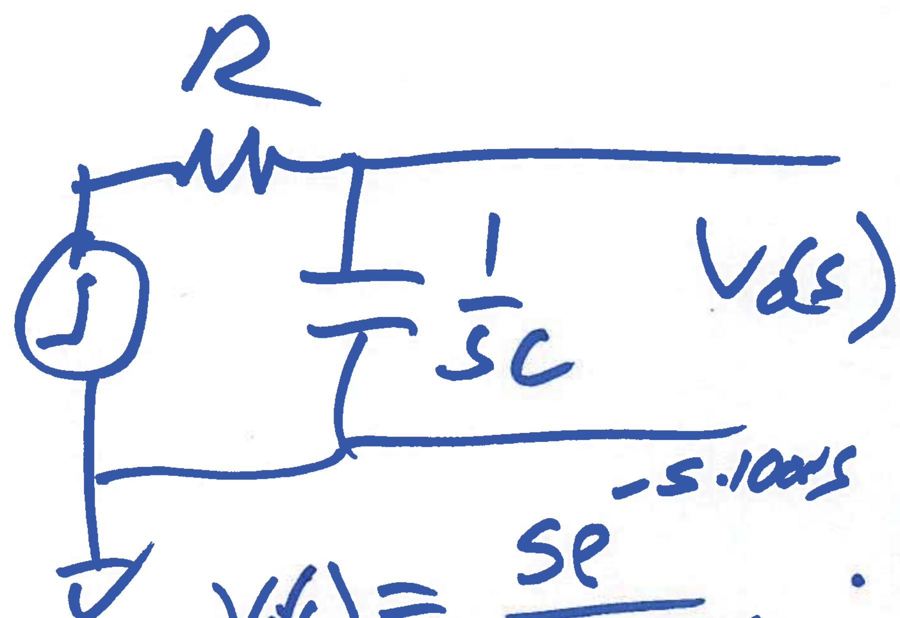
$$= \frac{5}{\frac{1}{150ns}} u(t) + -1 \frac{5}{150ns} \cdot e^{T/\gamma}_{150ns} \cdot e^{-\frac{t}{150ns}}$$

$$5 \cdot 150ns \left(1 + e^{-(t - 1)/150ns}\right.$$



$$5 \cdot \left(u(t-100ns) - u(t-1.1us) \right)$$

$$\frac{5e^{-s \cdot 100ns}}{s}$$



$$V_o(s) = \frac{5e^{-s \cdot 100ns}}{s \cdot RC} \cdot \frac{1}{s + \frac{1}{RC}}$$

$$V_o(s) = \frac{5e^{-s\cdot 100ns}}{s\cdot RC} \cdot \frac{1}{s+\frac{1}{RC}}$$

$$= \frac{A}{s} + \frac{B}{s+\frac{1}{RC}}$$

$$A = 5 \,,\; B = -5e^{-\frac{100ns}{-\frac{[illegible]}{RC}}}$$

$$\frac{\frac{1}{sC}}{\frac{1}{sC}+R} = \frac{1}{sRC+1} = \frac{1}{RC\left(s+\frac{1}{RC}\right)}$$

$$V_o(s) = \frac{5}{s} + \frac{-5e^{\frac{-100ns}{-RC}}}{s+\frac{1}{RC}}$$

$$v_o(t) = 5u(t) - 5e^{-t/RC}e^{\frac{-100ns}{-RC}}u(t-100ns)$$

$$= \cancel{5} \; 5\left(1 - e^{-\frac{(t-100ns)}{RC}}\right).$$

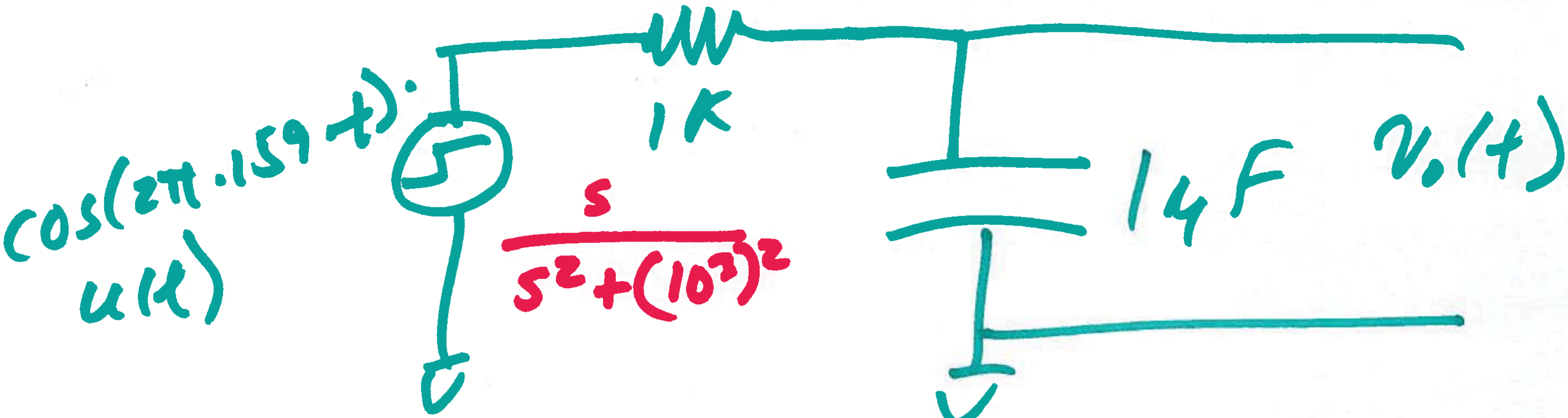
$$u(t-100ns)$$

$$\frac{d \cdot f(t)}{dt}$$

$$s \cdot F(s)$$

$$\int f(t)\,dt$$

$$\frac{1}{s}F(s)$$



$$V_o(s) = \frac{\frac{1}{sC}}{\frac{1}{sC} + 10^3} \cdot \frac{s}{s^2+10^6} = \frac{s}{s^2+10^6} \cdot \frac{1}{s \cdot 10^{-6} \cdot 10^3 + 1}$$

$$V_o(s) = \frac{s}{(s^2+10^6) \cdot 10^{-3}(s + 10^3)}$$

$$\frac{\cancel{s \cdot 10^{3}}\; s \cdot 10^{3}}{(s^2+10^6)\cdot(s+10^3)} = \frac{A}{s+10^3} + \frac{B}{s^2+10^6}$$

$$\cos x = \frac{e^{jx} + e^{-jx}}{2}$$

$$\sin x = \frac{e^{jx} - e^{-jx}}{2j}$$

$$A\Big|_{s=-10^3} = \frac{-10^{3} \cdot 10^{3}}{\underbrace{(-10^{3})^{2}}_{10^6} + 10^{6}} = \frac{-10^6}{2 \cdot 10^6} = \frac{-1}{2}$$

$$\boxed{A = -\frac{1}{2}}$$

$$\frac{s \cdot 10^3 \cancel{(s^2+10^6)}}{\cancel{(s^2+10^6)} \cdot (s+10^3)} = \left(\frac{-\frac{1}{2}\cancel{(s^2+10^6)}}{\cancel{s+10^3}} + \frac{B}{\cancel{s^2+10^6}} \right)\cancel{s^2+10^6}$$

0

$(s+10^3 j)\cdot$

$s^2+10^6 \quad (s-10^3 j)$

$(j10^3) + 10^6$

$-10^6 + 10^6 = 0$

$$B \Big|_{s=j10^3}$$

$$\frac{(j \cdot 10^3) \, 10^3}{j10^3 + 10^3} = B$$

$$V_o(s) = \frac{s \cdot 10^3}{(s^2+10^6)\cdot(s+10^3)} =$$

$$\frac{\cancel{A} \;\; -1/2}{s+10^3} + \frac{B}{s+j\cdot 10^3} + \frac{C}{s-j10^3}$$