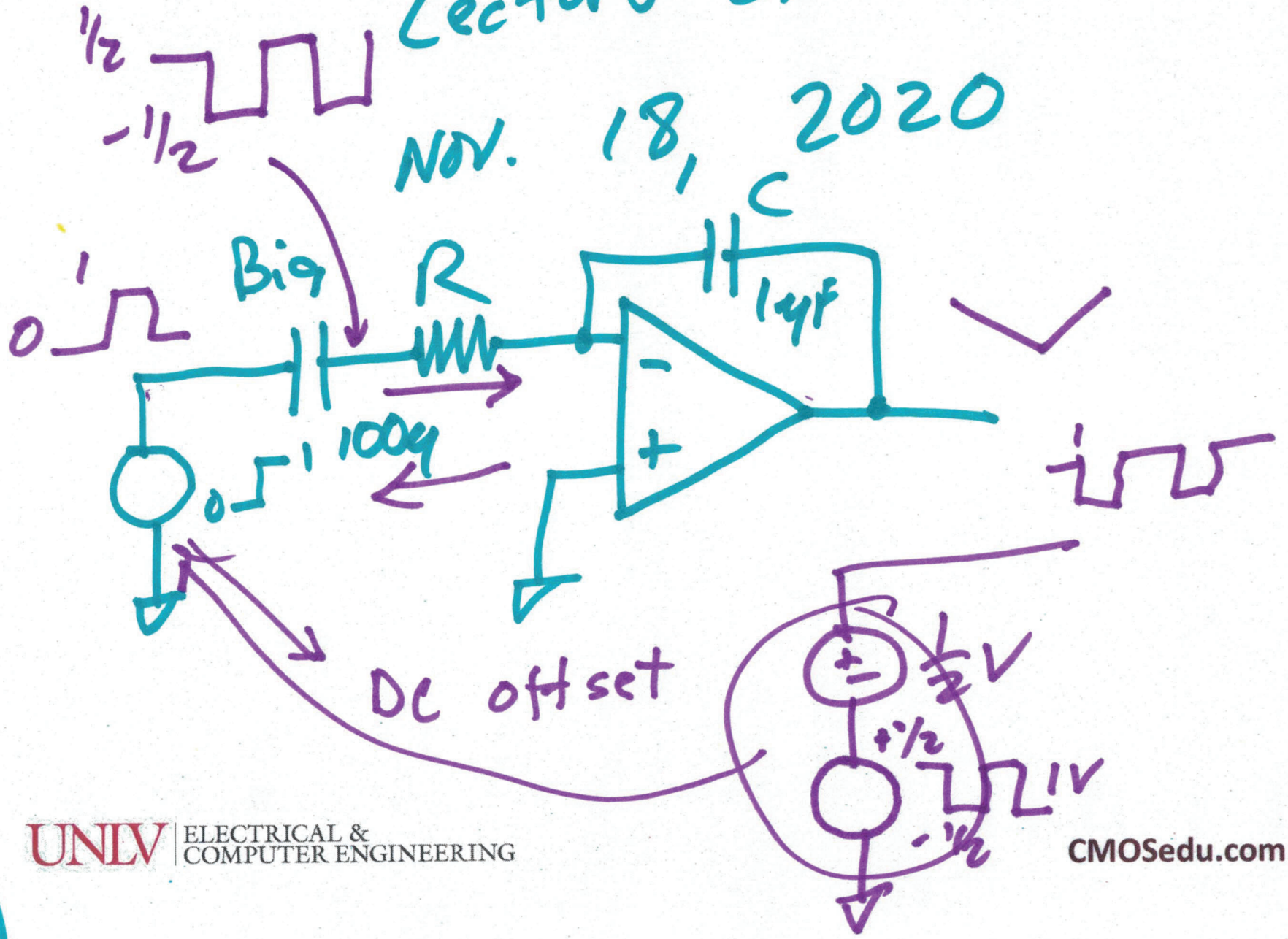
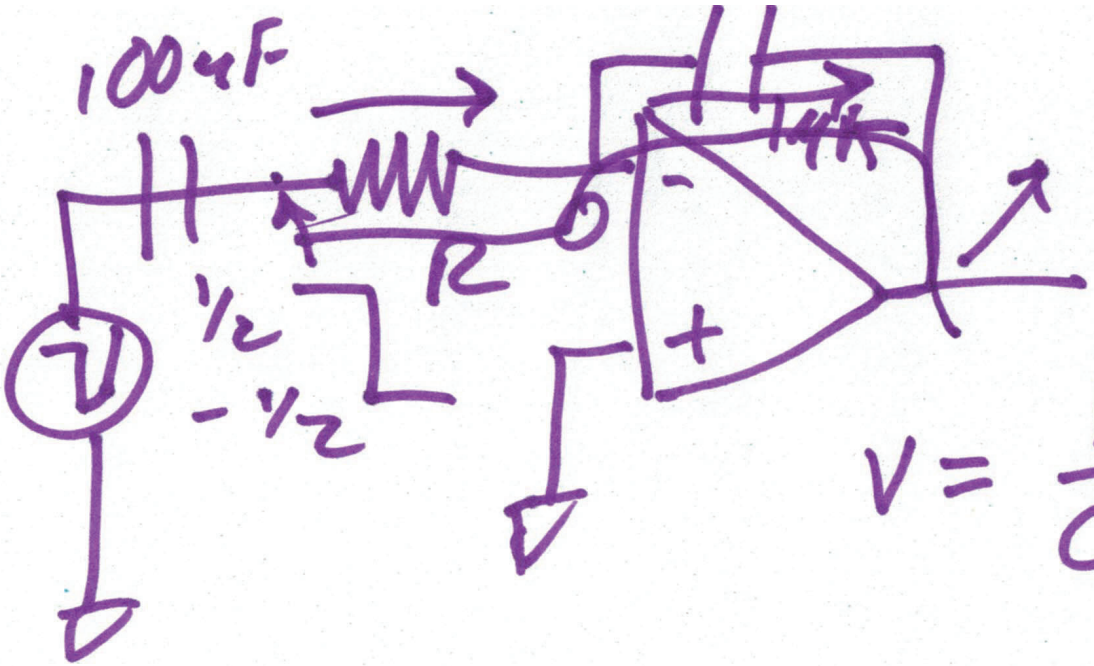
EE 220 circuits 1

Lecture 23

NOV. 18, 2020



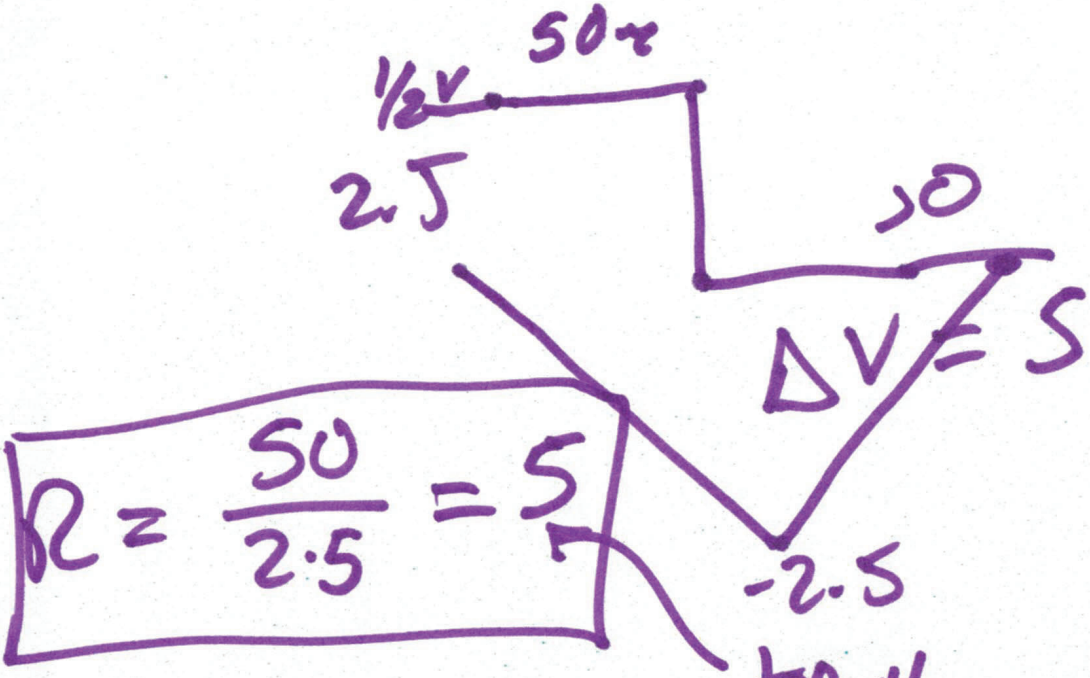


$10KHz = \frac{1}{T}$

$T = 100\mu s$

$V = \frac{1}{C}\int_0^t i \cdot dt$

$i = \frac{1/2}{R}$

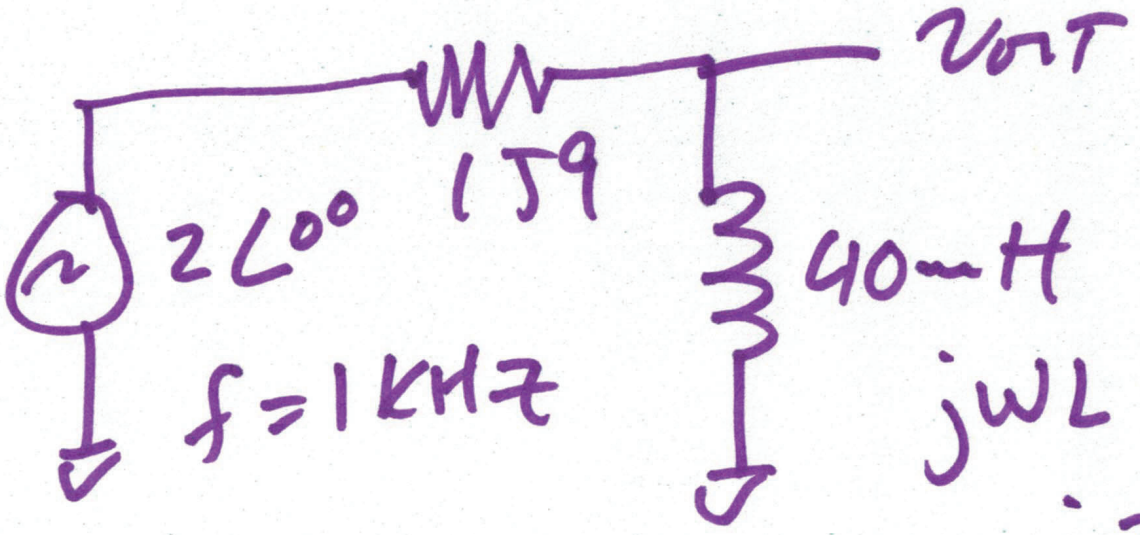


$R = \frac{50}{2.5} = 5\Omega$

$5 = \frac{1}{10^{-6}}\int_0^{50\mu s} \frac{1/2}{R} \cdot dt$

too small $5 = \frac{1}{2 \cdot 10^{-6}} \cdot \frac{1}{R}(50x - 0)$

2)



$$j\omega L \rightarrow j \cdot 2\pi \cdot 40m \cdot 10^3$$

$$j251$$

$$V_{OUT} = 2 \cdot \frac{0 + j251}{159 + j251}$$

$$V_{OUT} = \frac{0 + j \cdot 502}{159 + j251}$$

$$V_{OUT} = \frac{502 \angle 90^\circ}{297 \angle 57.6^\circ}$$

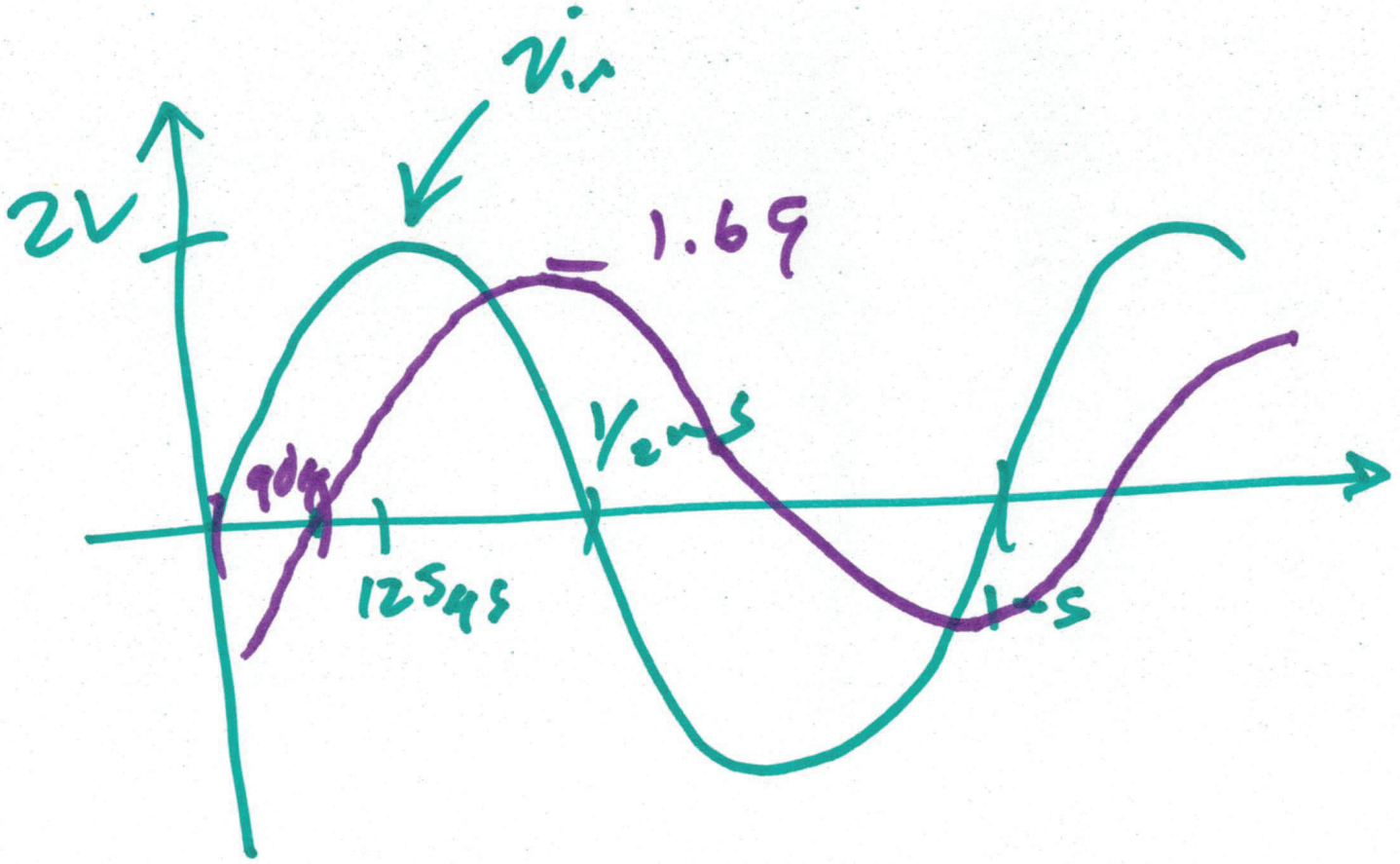
$$V_{OUT} = 1.69 \angle 32.4^\circ$$

$$V_{IN} = 2 \sin(2\pi \cdot 10^3 \cdot t)$$

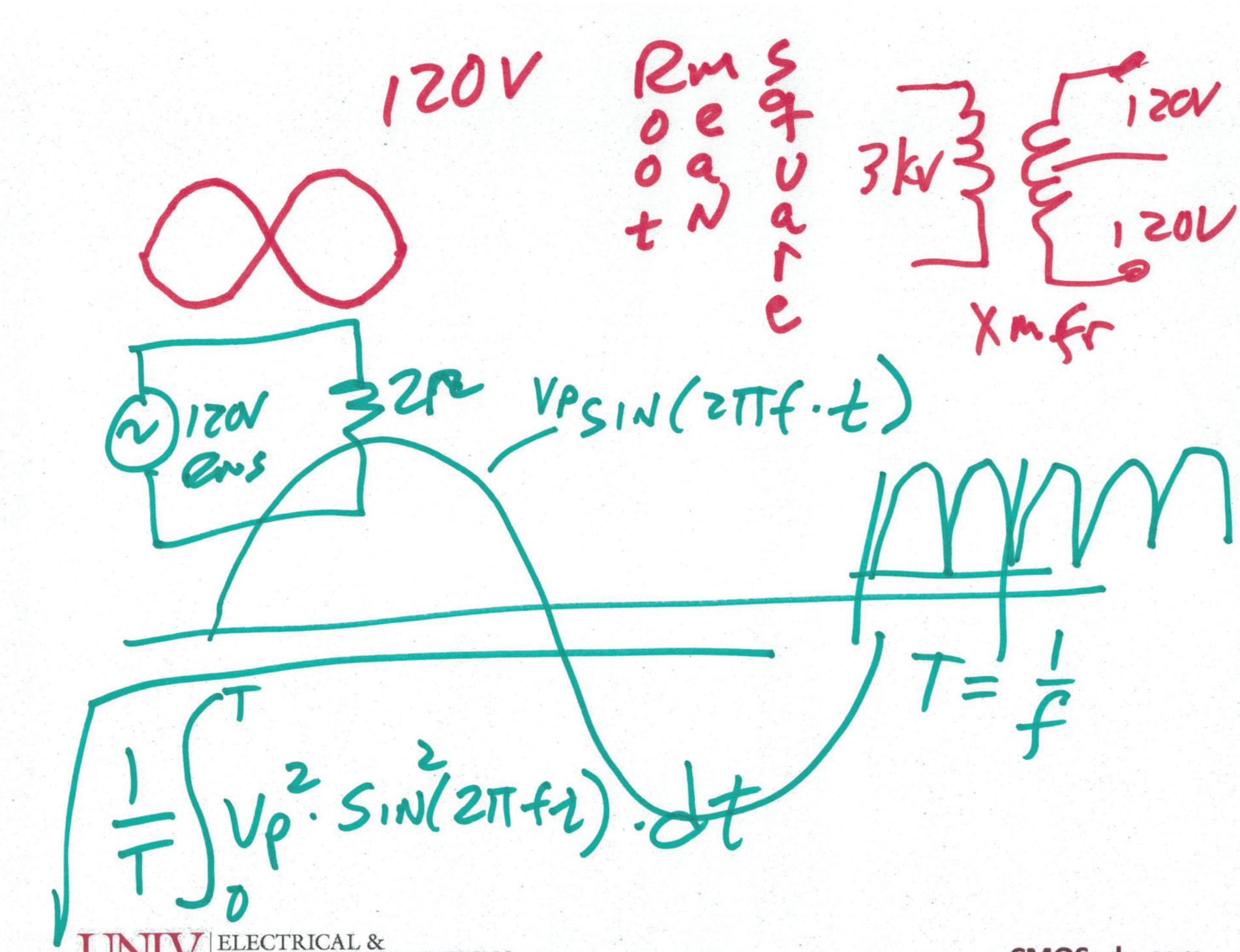
$$V_{OUT} = 1.69 \sin(2\pi \cdot 10^3 \cdot t + 32.4^\circ)$$

$$32.4 = \frac{t_d}{1\text{ms}} \cdot 360 \rightarrow t_d = 90\,\mu s$$

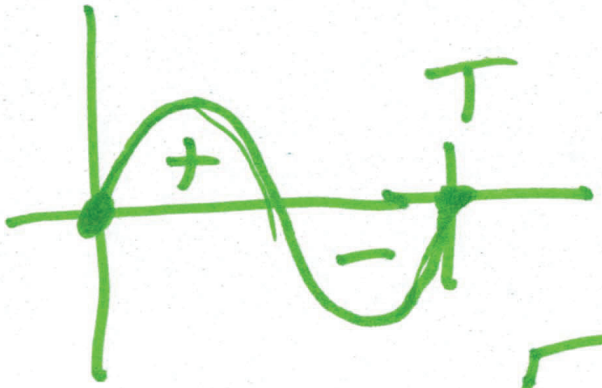
4)


2V
1.6φ
90deg
125ms
1/8ms
1ms

120V Root Mean Square



$$V_{RMS} = \sqrt{\frac{1}{T}\int_0^T V_p^2 \sin^2(2\pi f t)}$$



$$\sin x = \frac{1-\cos 2x}{2}$$

$$f = \frac{1}{T}$$

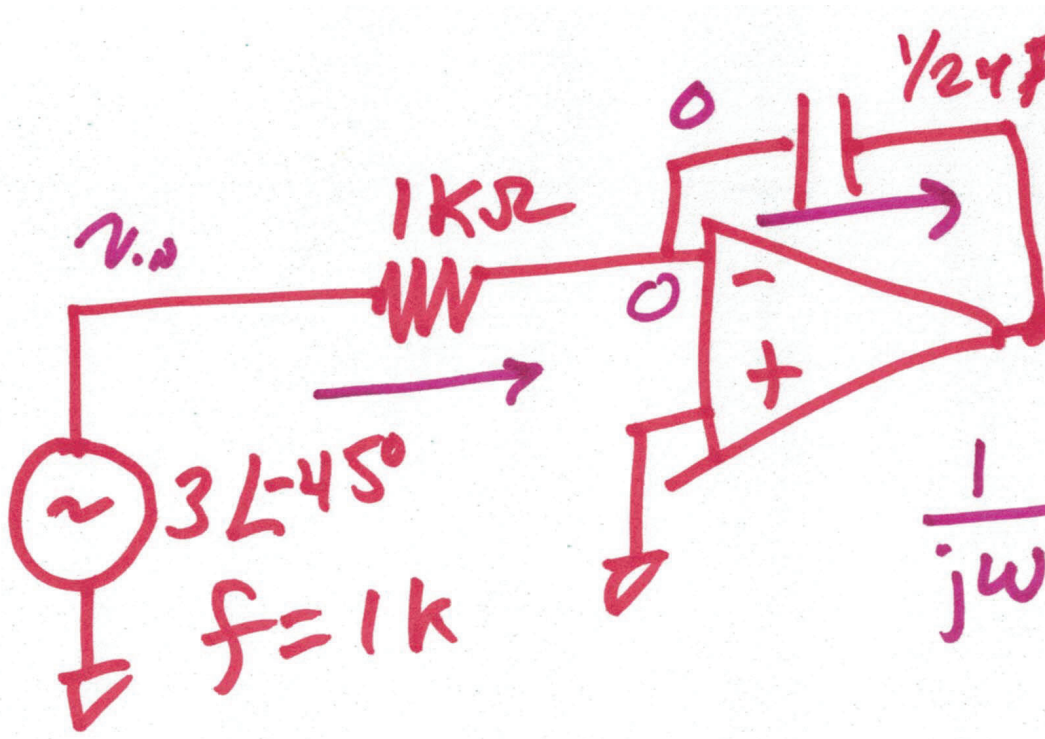
$$= \sqrt{\frac{V_p^2}{2T}\int_0^T (1-\cos 2\cdot 2\pi f\cdot t)\,dt}$$

$$V_{RMS} = \sqrt{\frac{V_p^2}{2}\cdot\frac{1}{T}\left(T + \frac{\sin(2\pi\cdot f\cdot t)}{4\pi f}\right)\Bigg|_0^0}$$

$$V_{rms} = \frac{V_p}{\sqrt{2}}$$

$$120V = \frac{V_p}{\sqrt{2}} \qquad V_p \cong 170V$$

$$v_{wall}(t) = 170 \cdot \sin(2\pi \cdot 60 \cdot t)$$



$$\frac{1}{j\omega C} = \frac{-j}{2\pi \cdot 10^3 \cdot \frac{1}{10^6}} = -j318$$

$$v_{in} = 3\sin(2\pi \cdot 1\text{kHz} \cdot t - 45°)$$

$$\frac{3\angle -45}{1K} = 3mA\angle -45 = \frac{0 - v_{out}}{\frac{1}{j\omega C}}$$

$$\frac{1}{j} = \frac{1}{\sqrt{-1}} \cdot \frac{\sqrt{-1}}{\sqrt{-1}} = \frac{j}{-1} = -j$$

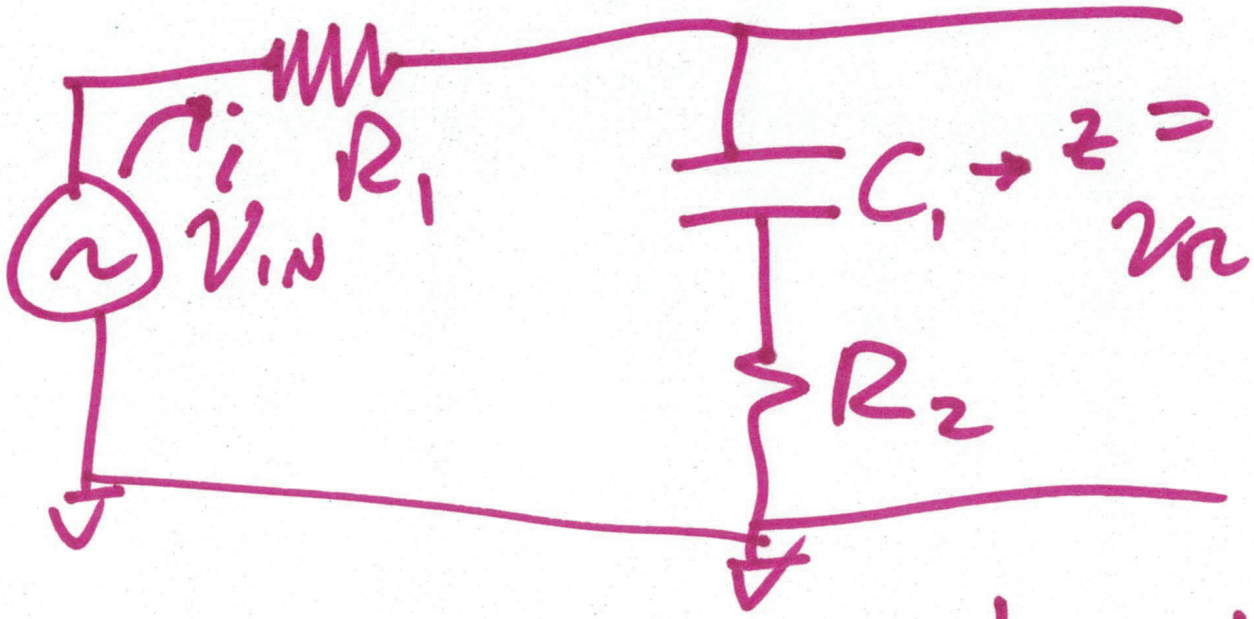
$$3\angle -45 = \frac{-V_{oT}}{-j318} = \frac{V_{oT}}{318\angle 90^\circ}$$

$$V_{oT} = 318\angle 90 \cdot 3\angle -45$$

$$= .954\angle 45^\circ$$

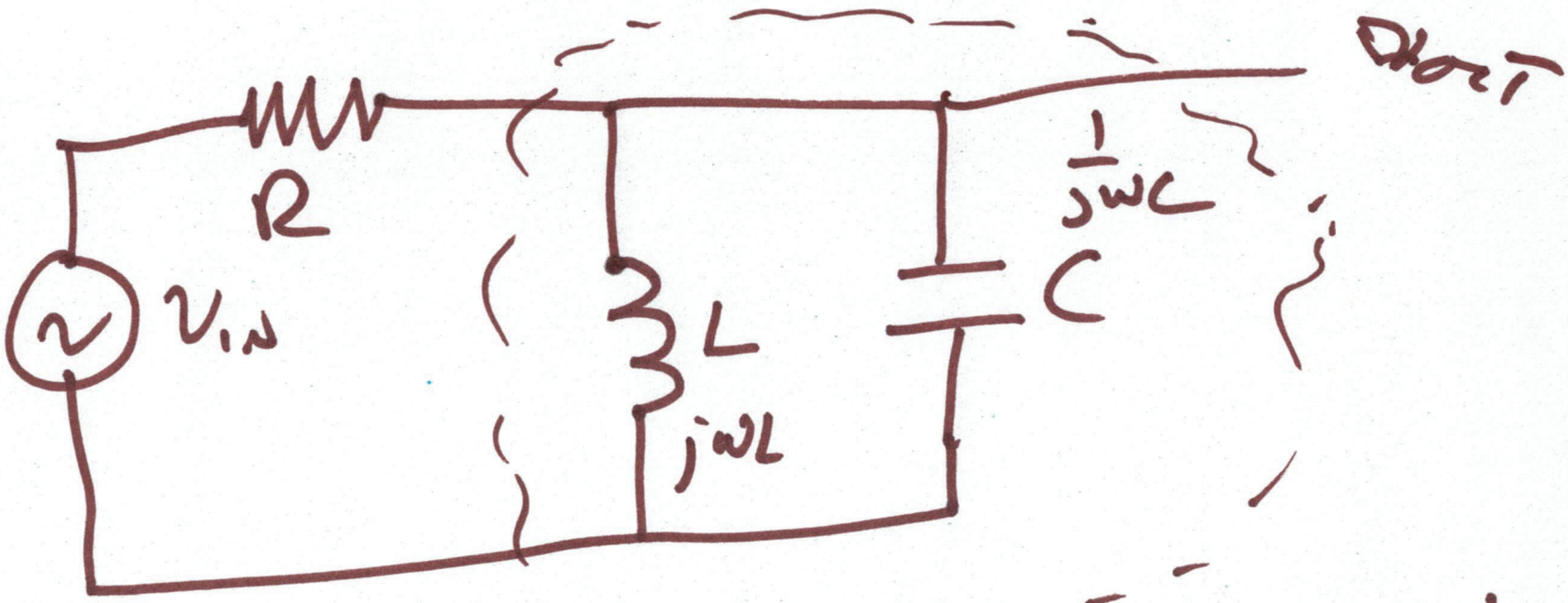
$$V_{oT} = .954 \sin(2\pi \cdot 10^3 t + 45^\circ)$$

$$45 = \frac{t_d}{1\text{ms}} \cdot 360 \rightarrow t_d = 125\mu s$$



$$V_{out} = V_{in} \cdot \frac{\frac{1}{j\omega C_1} + R_2}{\frac{1}{j\omega C_1} + R_2 + R_1}$$

$$i_{in} = \frac{V_{in}}{R_1 + R_2 + \frac{1}{j\omega C_1}}$$



$$V_{out} = V_{in} \cdot \frac{Z_{eq}}{R + Z_{eq}}$$

$$Z_{eq} = \frac{j\omega L \cdot \frac{1}{j\omega C}}{j\omega L + \frac{1}{j\omega C}}$$

$$= \frac{\frac{L}{C}}{j\omega L + \frac{1}{j\omega C}}$$

$$\frac{j\omega L}{-\omega^2 LC + 1} = \frac{j\omega L}{j\omega L \cdot j\omega C + 1}$$