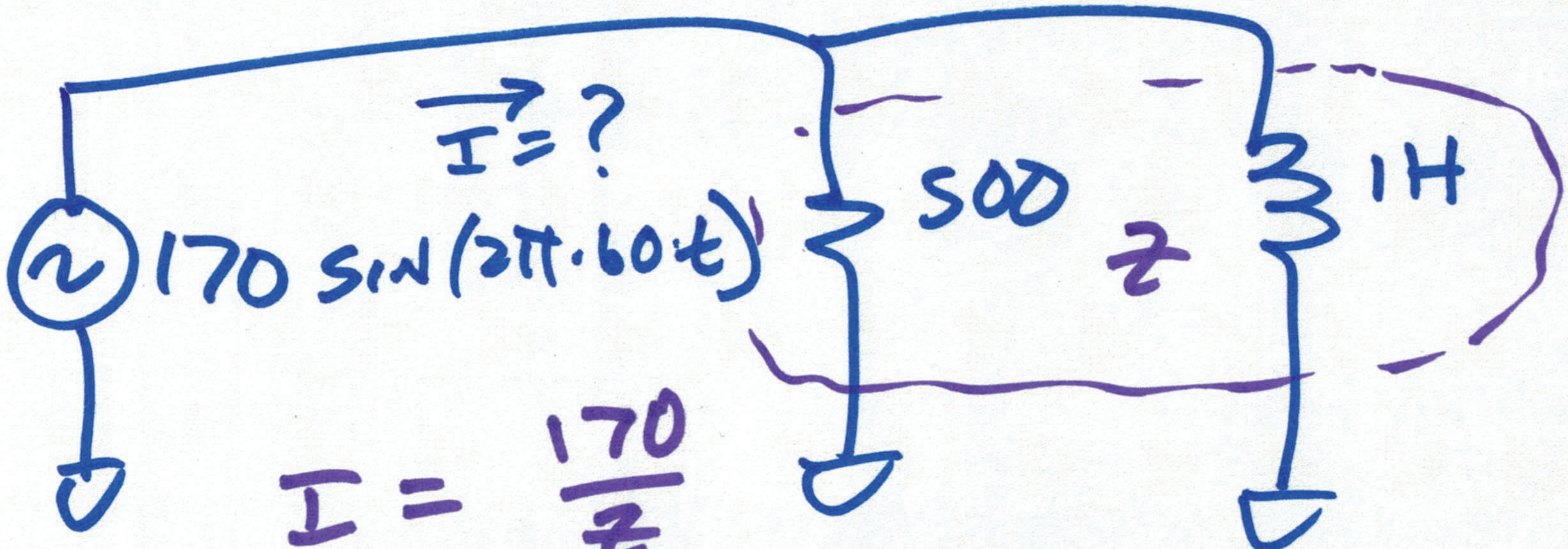
EE 221 Circuits II

Lecture 25

[redacted] April 26, 2023



$$I = \frac{170}{Z}$$

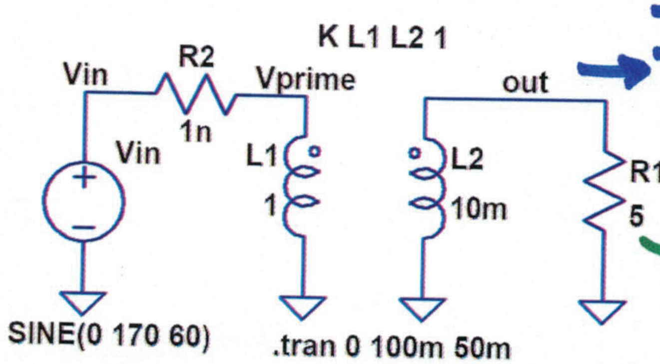
$$Z = \frac{500 \cdot j\omega \cdot 1}{500 + j\omega \cdot 1}$$

Quiz #22 EE 221 Spring 2021 Name:________________________________

Closed book and notes.

Show your work for credit and place a box around your answer.

1. Find the current flowing in Vin (write an equation in the time domain). (5 points)



$\rightarrow I_2$

$+$

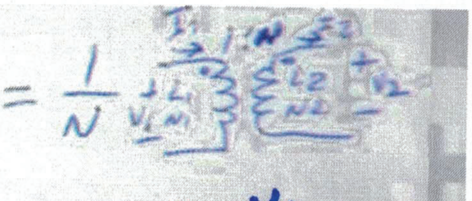
V_2

$-$

$\rightarrow \frac{V_{rms}^2}{5}$

$\left(\frac{\frac{17}{\sqrt{2}}}{5}\right)^2$

$$\frac{I_2}{I_1} = \frac{V_1}{V_2} = \frac{N_1}{N_2} = \sqrt{\frac{L_1}{L_2}} = \frac{1}{N}$$



$$5 = \frac{V_2}{I_2} = \frac{V_1 \cdot \frac{N_2}{N_1}}{I_1 \cdot \frac{N_1}{N_2}} = \frac{V_1}{I_1}\left(\frac{N_2}{N_1}\right)^2$$

$$5 = \frac{V_1}{I_1} \cdot \left(\sqrt{\frac{L_2}{L_1}}\right)^2 = \frac{V_1}{I_1}\left(\sqrt{\frac{1}{100}}\right)^2$$

$$\frac{V_1}{I_1} = 500$$

2)

$$I = \frac{170\angle 0}{\dfrac{500\cdot j\omega\cdot 1}{\cancel{500 + j\omega\cdot 1}}} \cdot \frac{500 + j\omega 1}{\cancel{500 + j\omega 1}}$$

$$I = \frac{170(500 + j\omega)}{0 + 500\cdot j\omega}$$

$$|I| = \frac{170\cdot\sqrt{500^2 + (2\pi 60)^2}}{\sqrt{0^2 + (500\cdot 2\pi\cdot 60)^2}} = \frac{\cancel{88{,}760}}{\cancel{188{,}400}} = \cancel{.47}\ .56$$

$$\angle I = \overset{37}{\tan^{-1}\frac{2\pi 60}{500}} - \cancel{\tan^{-1}\infty} \rightarrow 90$$

$$\approx 0 \quad -53^\circ$$

$$i(t) = 560\,\text{mA}\,\sin(2\pi 60 t - 53°)$$

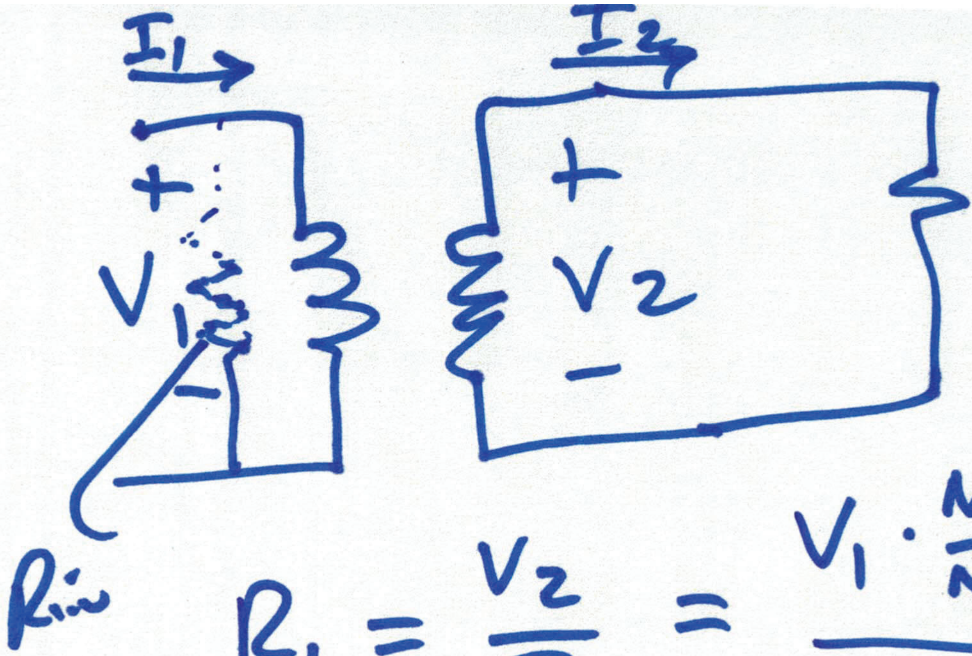
$V_1 = 170$

$$V_2 = \sqrt{\frac{L_2}{L_1}} \cdot V_1$$

$$\sqrt{\frac{10m}{1}} \cdot \overset{170}{170} = \sqrt{\frac{1}{100}} \cdot 170$$

$$V_2 = 17$$

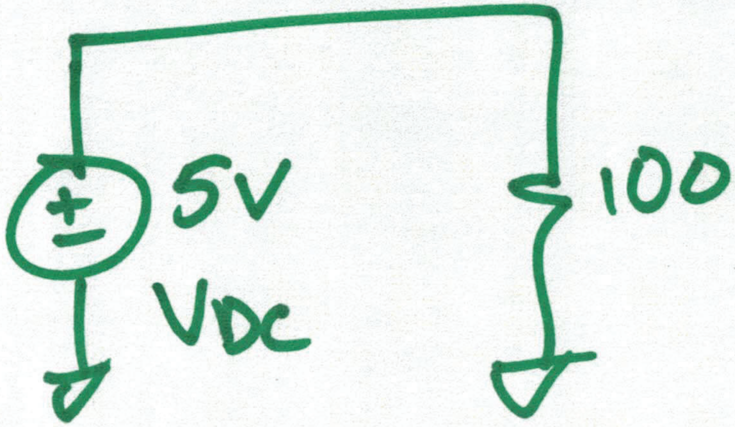
$$I_2 = \frac{17}{5} = 3.4\,A$$



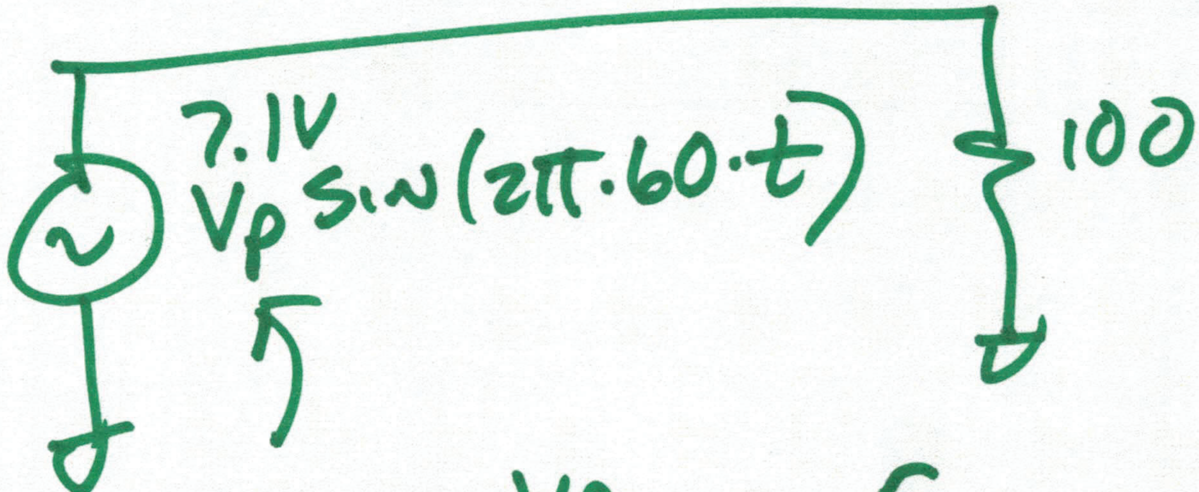
$$\frac{V_1}{V_2} = \frac{N_1}{N_2} = \sqrt{\frac{L_1}{L_2}} = \frac{I_2}{I_1}$$

$$R_L = \frac{V_2}{I_2} = \frac{V_1 \cdot \frac{N_2}{N_1}}{I_1 \cdot \frac{N_1}{N_2}} = \underbrace{\frac{V_1}{I_1}}_{R_{in}} \cdot \left(\frac{N_2}{N_1}\right)^2$$

$$R_{in} = R_L \cdot \left(\frac{N_1}{N_2}\right)^2 = R_L \cdot \frac{L_1}{L_2}$$



$V_{DC} = V_{rms}$

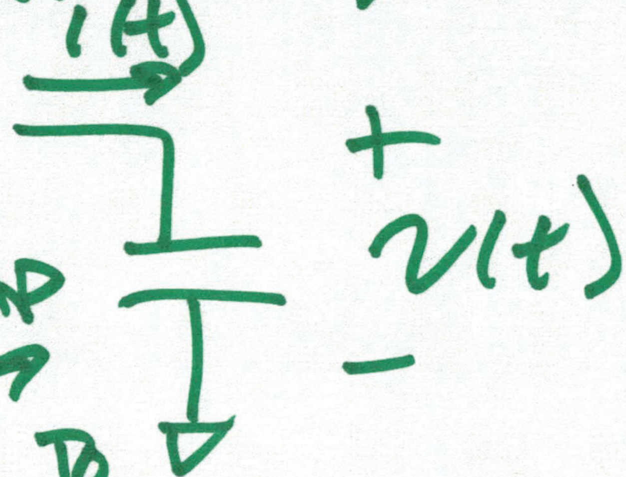


$$\frac{V_p}{\sqrt{2}} = 5$$

$$V_p = \sqrt{2}\cdot 5 = 7.1V$$

instantaneous

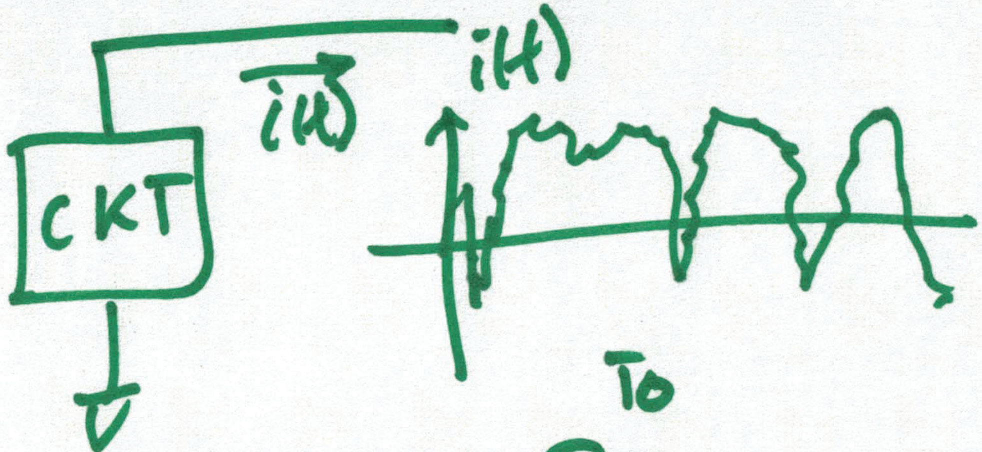
$$p(t) = i(t) \cdot v(t)$$



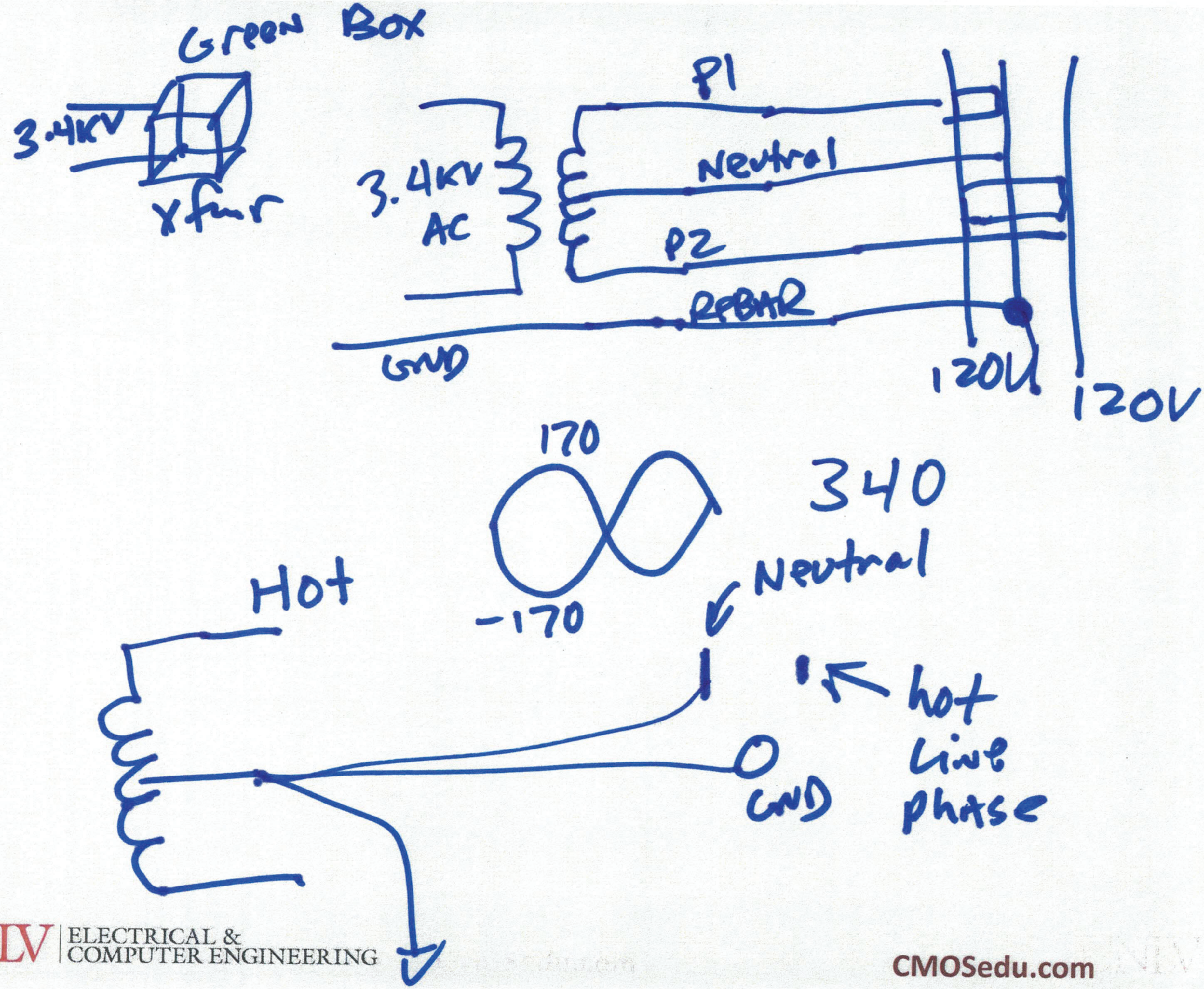
for a cap

$$P_{AVG} = \frac{1}{T_0} \int^{T_0} p(t) \cdot dt = 0$$

12.5 V = constant



$$P_{AVG} = \frac{1}{T_0}\int_0^{T_0} 12.5 \cdot i(t) \cdot dt$$


Green Box
3.4KV
Xfmr
3.4KV
AC
P1
Neutral
P2
REBAR
GND
120V
120V
170
-170
340
Hot
Neutral
hot
line
phase
GND


AC
Hot
Neut