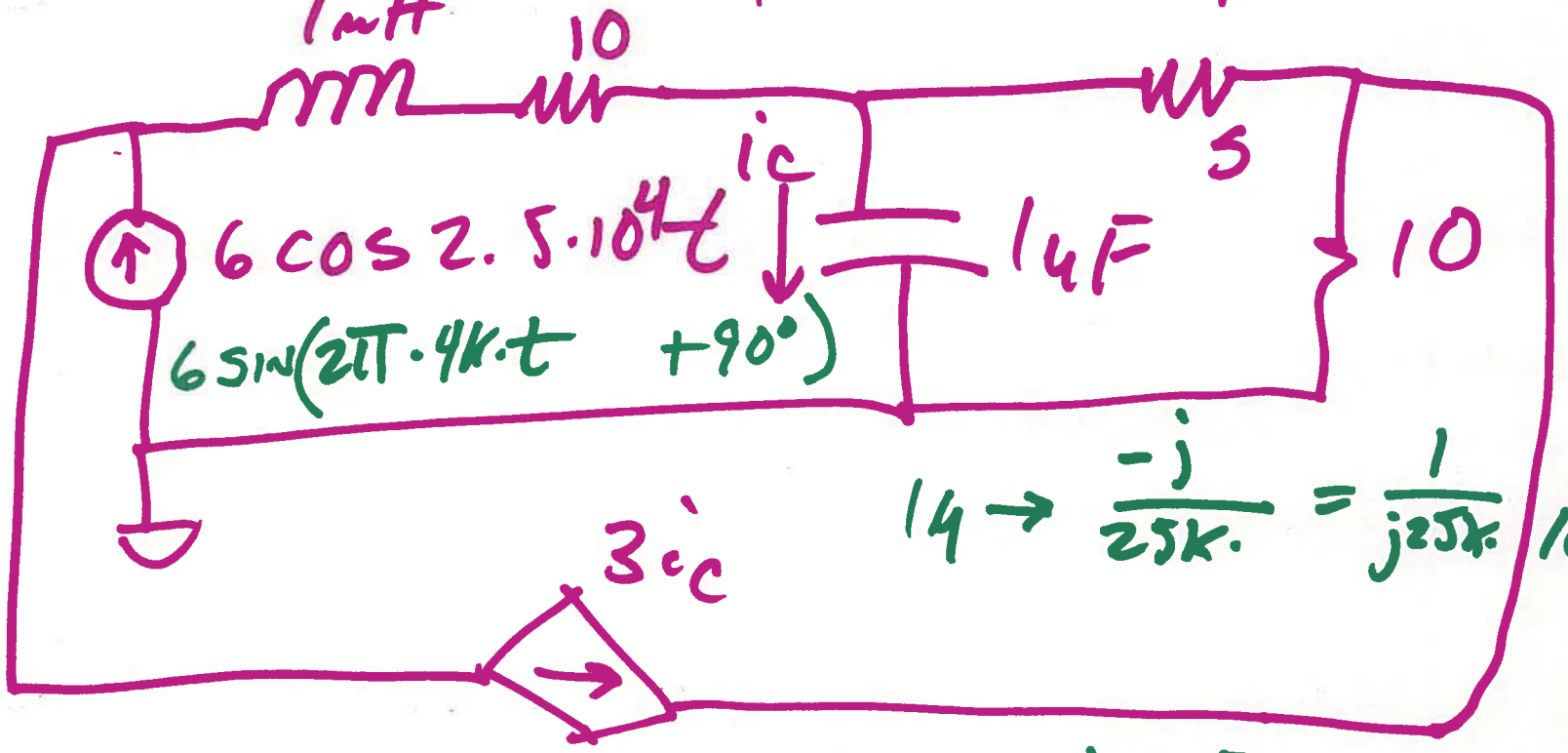
EE 221 Circuits II

Lecture 9

Feb. 25, 2019

$2\pi f = 2.5 \times 10^4$

$f = \frac{2.5 \times 10^4}{6.28}$

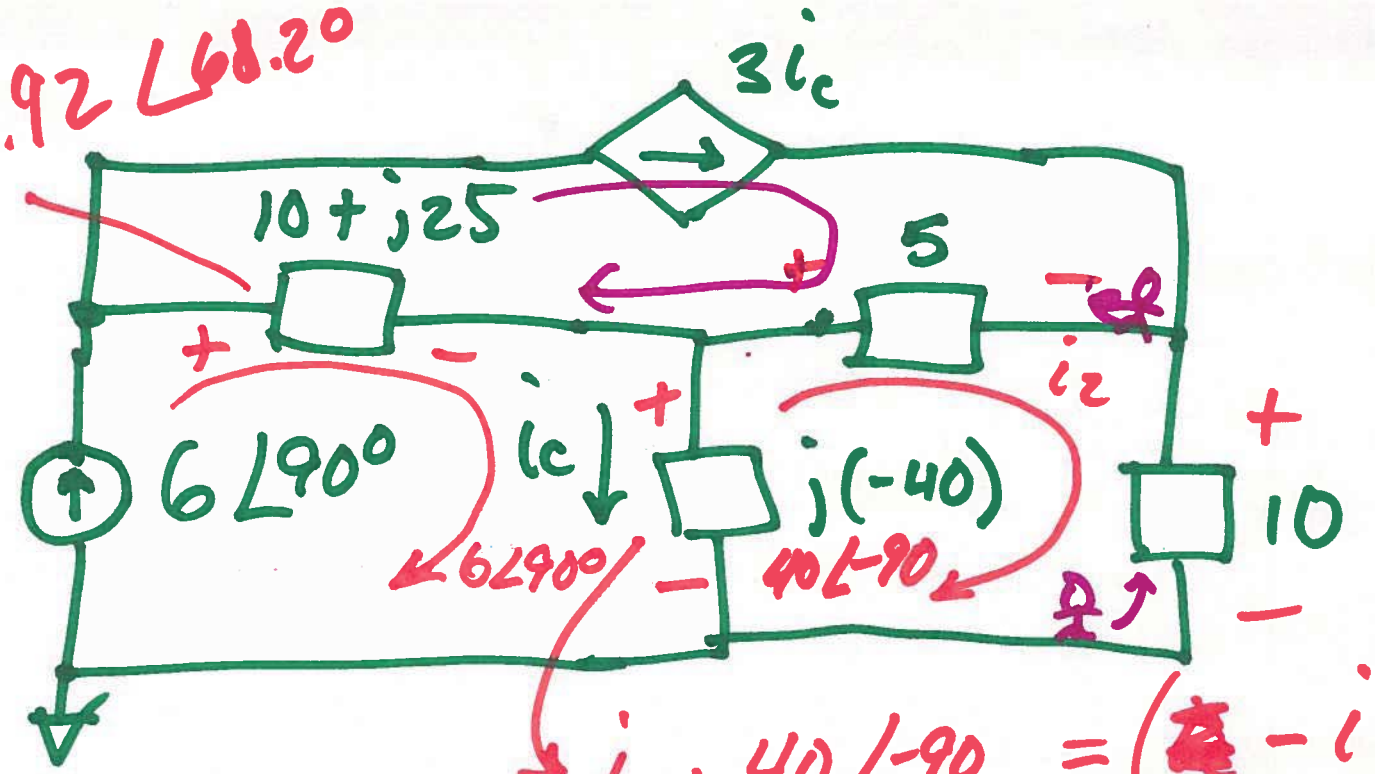


$1\mu \rightarrow \frac{-j}{25K} = \frac{1}{j25K} 10^{-6} = -j40$

$1mH \rightarrow j \cdot 2\pi \cdot 4K \cdot 0.001 = j \cdot 25K \cdot .001 = \boxed{25j = Z_L}$

25000×0.001

1)



$$i_c \cdot 40\angle -90 = \left(6\angle 90° - i_2\right) \cdot 40\angle -90$$

$$10 \cdot i_2 + 5\left(i_2 - 3i_c\right) - i_c \cdot j(-40) = 0$$

$$i_c = 6\angle 90 - i_2 \rightarrow i_2 = 6\angle 90 - i_c$$

$$15 i_2 - i_c(15 - 40j) = 0$$

$$15(6\angle 90 - i_c) - i_c \cdot 15 + i_c \cdot 40j = 0$$

$$90\angle 90 + i_c(-30 + 40j) = 0$$

$-90\angle 90$

$\Leftarrow$ ↑ NO!

$50\angle 126.7°$

$$i_c \cdot 50\angle 126.7° = 90\angle 270° \quad 1.8A$$

$$i_c = \frac{90\angle 270°}{50\angle 126.7} = \frac{9}{5}\angle 143.3°$$

$90\sin(25kt + 90)$ $\quad i_c(t) = 1.8\sin(25kt + 143.3°)$ A

$-90\sin(25kt + 90)$

$= 90\sin(25kt + 270)$

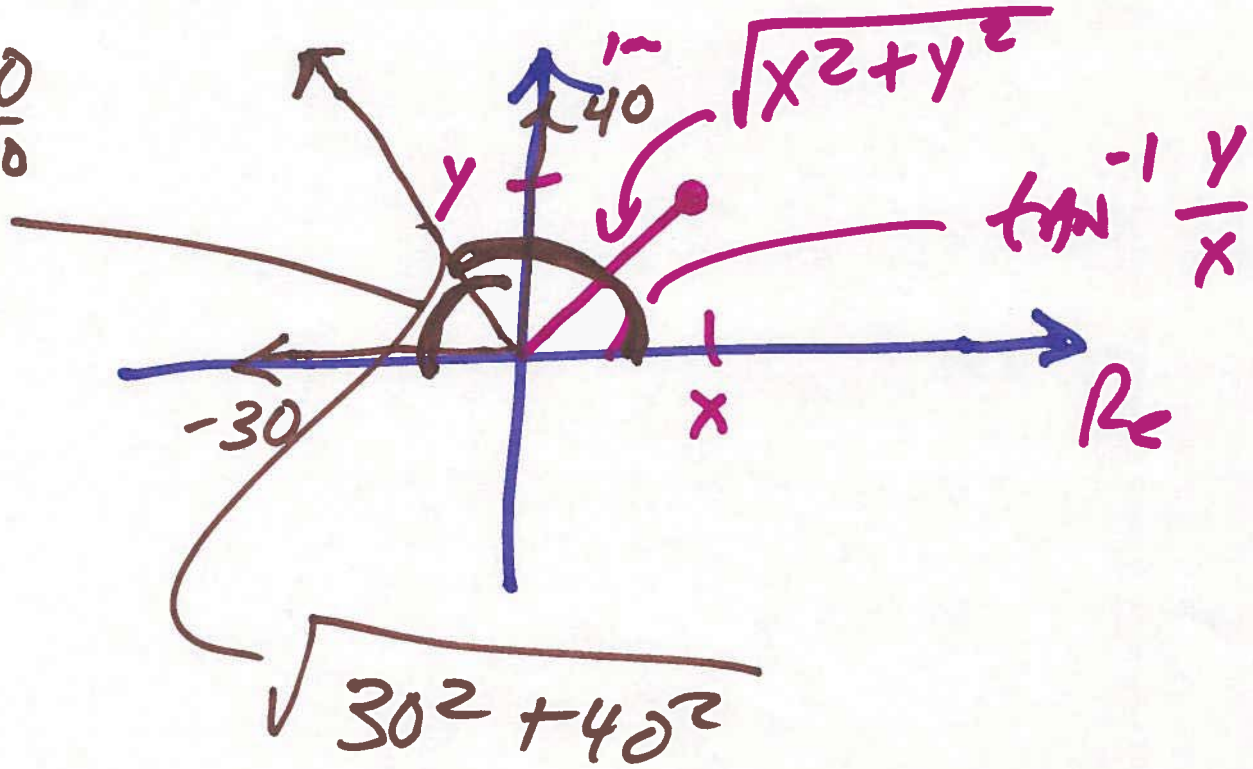
3)

-53.3°

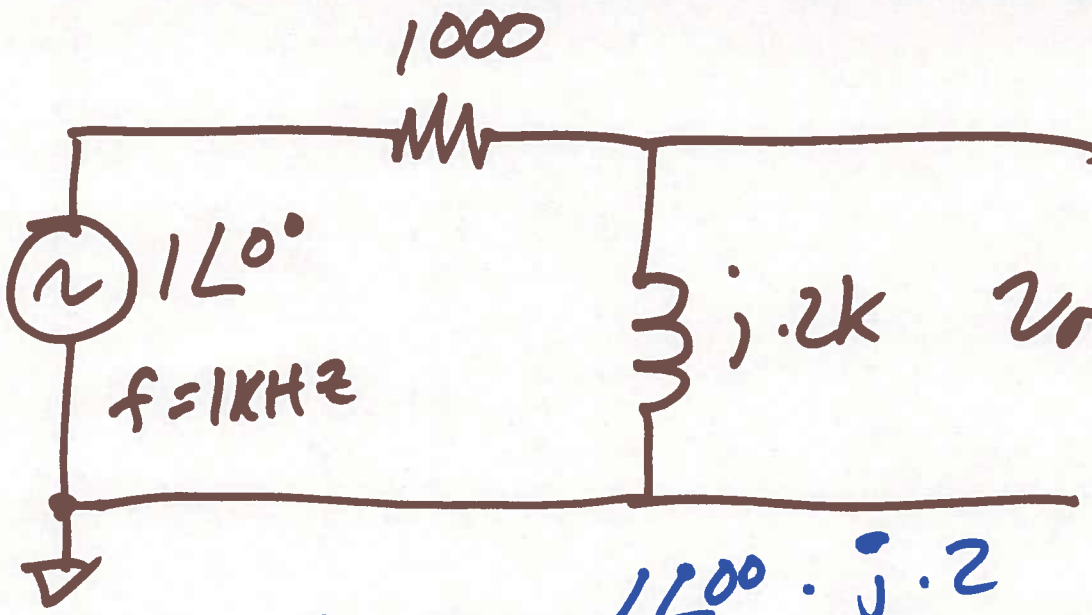
$-30 + j40$

$\parallel$

$\tan^{-1}\frac{40}{-30}$



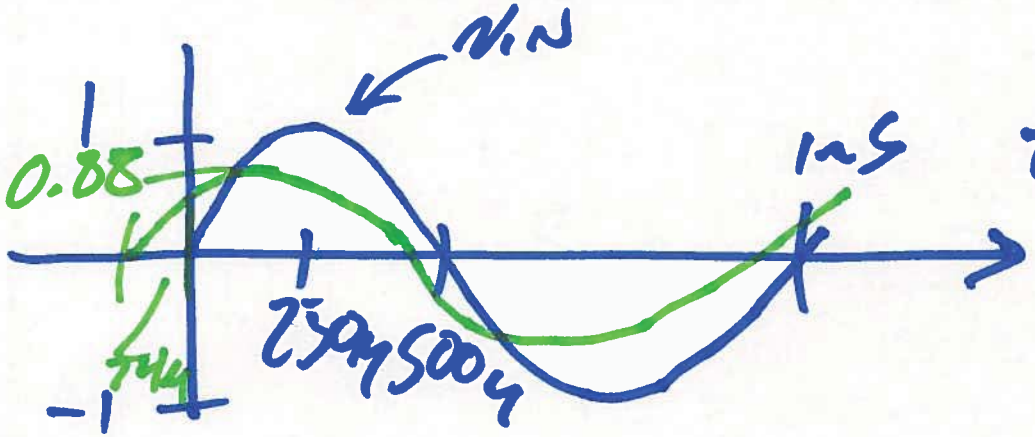
4)



$$V_{OUT} = 1\angle 0^\circ \cdot \frac{j2k}{1k + j2k}$$

$$V_{OUT} = \frac{1\angle 0^\circ \cdot j \cdot 2}{1 + j \cdot 2} = \frac{1\angle 0^\circ \cdot 2\angle 90^\circ}{\sqrt{5}\angle 63.4^\circ}$$

$$V_{OUT} = 0.88 \sin(2\pi \cdot 1k \cdot t + 26.6) = \frac{0.88}{0.88}\angle 26.6$$

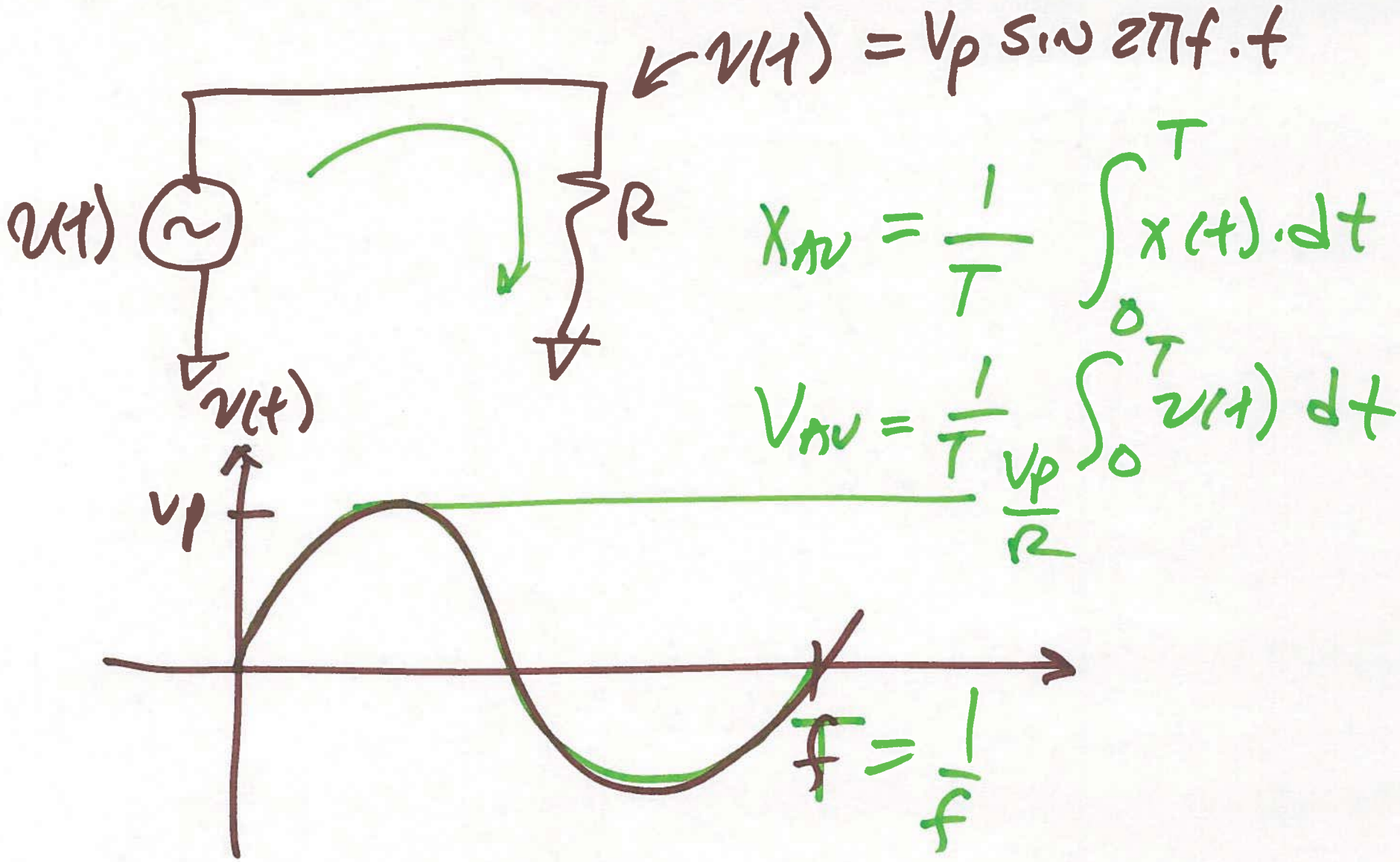


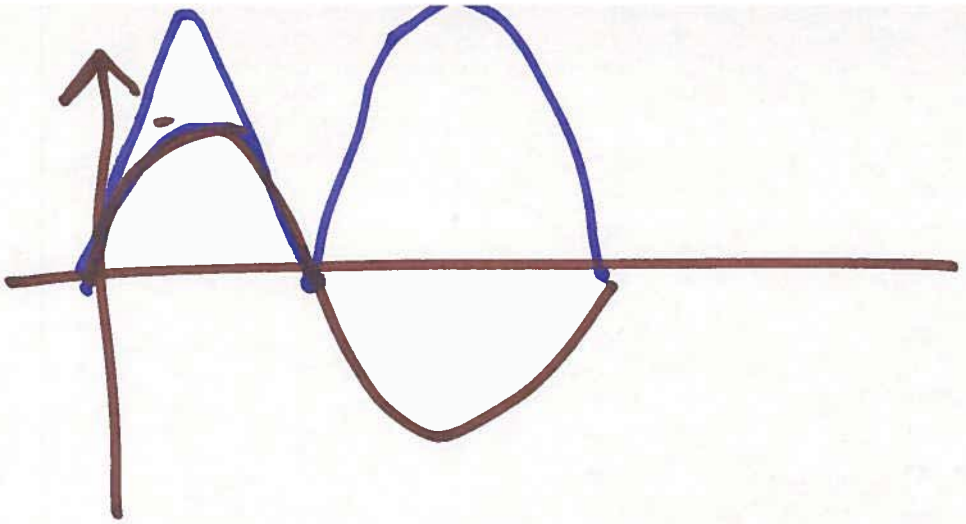
$$t_d \cdot f \cdot 360 = \frac{t_d}{T} \cdot 360 = 26.6$$

$$t_d = \frac{26.6}{360 \cdot 1k}$$

$$= 74\mu S$$

5)


v(t) = Vp sin 2πf.t
v(t)
R
v(t)
Vp
Vp/R
f = 1/f
$X_{AV} = \frac{1}{T}\int_0^T x(t).dt$
$V_{AV} = \frac{1}{T}\int_0^T v(t)\,dt$



$$P = \frac{V^2}{R}$$

Root MEAN SQUARE

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

$$= \sqrt{\frac{V_p^2}{2T}\int_0^T (1-\cos(4\pi f\cdot t))\,dt}$$

$$V_{RMS} = \sqrt{\frac{V_{p^2}}{2}}$$

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

output of wall socket

120V Rms ± 5%

114 → 124

$$V_p = \sqrt{2} \cdot 120 = 170$$

$$V(t) = 170 \sin(2\pi \cdot 60 \cdot t)$$

Power in Resistive Load AC

$$P_{AC} = \frac{V_{Rms}^2}{R}$$

Power in resistive load DC

$$P_{DC} = \frac{V_{DC}^2}{R}$$