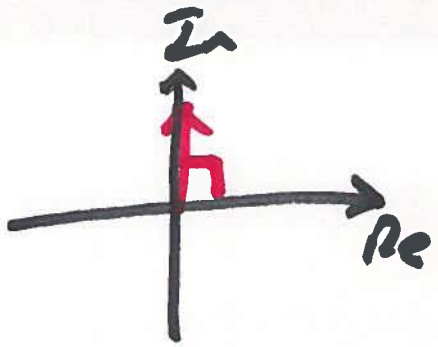
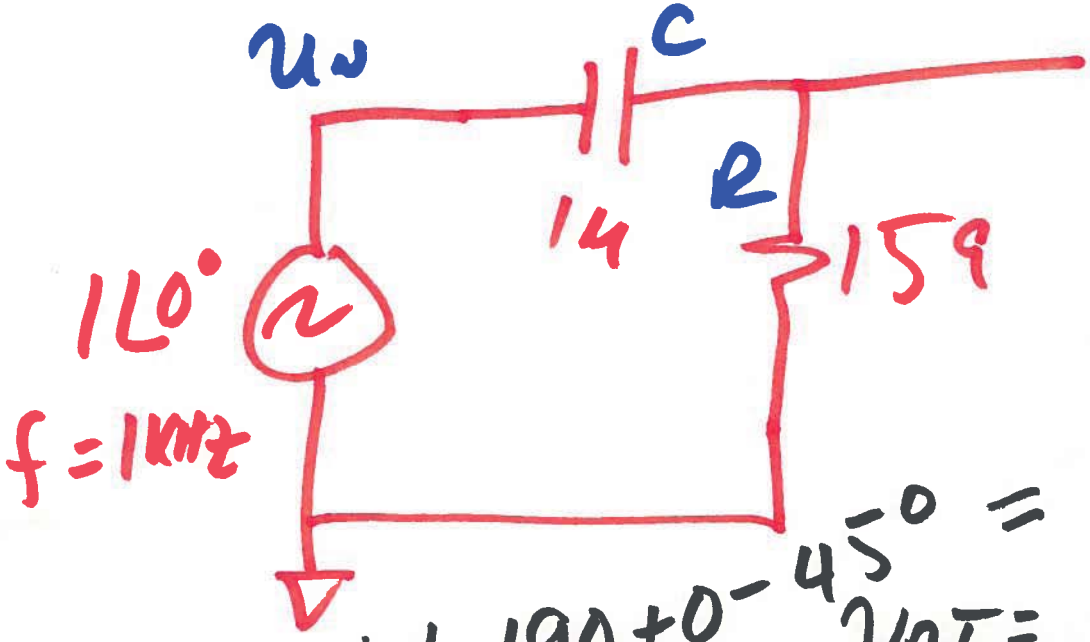
EE 220
Circuits 1

$2\pi \cdot 10^3 \cdot 159 \cdot 10^{-6} = 2\pi f RC = \omega RC = 1$



Lecture 26



$$v_{out} = v_{in} \cdot \frac{R}{R + \frac{1}{j\omega C}}$$

$$v_{out} = v_{in} \cdot \frac{0 + j\omega RC}{1 + j\omega CR}$$

$$v_{out} = \frac{1.1}{\sqrt{2}} \angle 90 + 0 - 45^\circ = \frac{1}{\sqrt{2}} \angle 45^\circ$$

$$v_{out} = 1\angle 0^\circ \cdot \frac{\sqrt{0^2 + (\omega RC)^2}\ \angle \tan^{-1}\frac{\omega RC}{0}^{90}}{\sqrt{1^2 + (\omega RC)^2}\ \angle \tan^{-1}\frac{\omega RC}{1}}$$

$$= \frac{1\angle 0^\circ \cdot 1\angle 90}{\sqrt{2}\ \angle 45}$$

$$V_{out}(s) = V_{in} \cdot \frac{2\pi fRC \angle 90}{\sqrt{1+(2\pi fRC)^2} \angle \tan^{-1} \omega RC}$$

$$\left|\frac{V_{out}}{V_{in}}\right| = \frac{2\pi fRC}{\sqrt{1+(2\pi fRC)^2}} = \frac{\frac{f}{f_z}}{\sqrt{1+\left(\frac{f}{f_p}\right)^2}}$$

$$\angle \frac{V_{out}}{V_{in}} = 90 - \tan^{-1} 2\pi f RC$$

$$90 - \tan^{-1} \frac{f}{f_p}$$

$$f_z = \frac{1}{2\pi RC} = 1000 = f_p$$

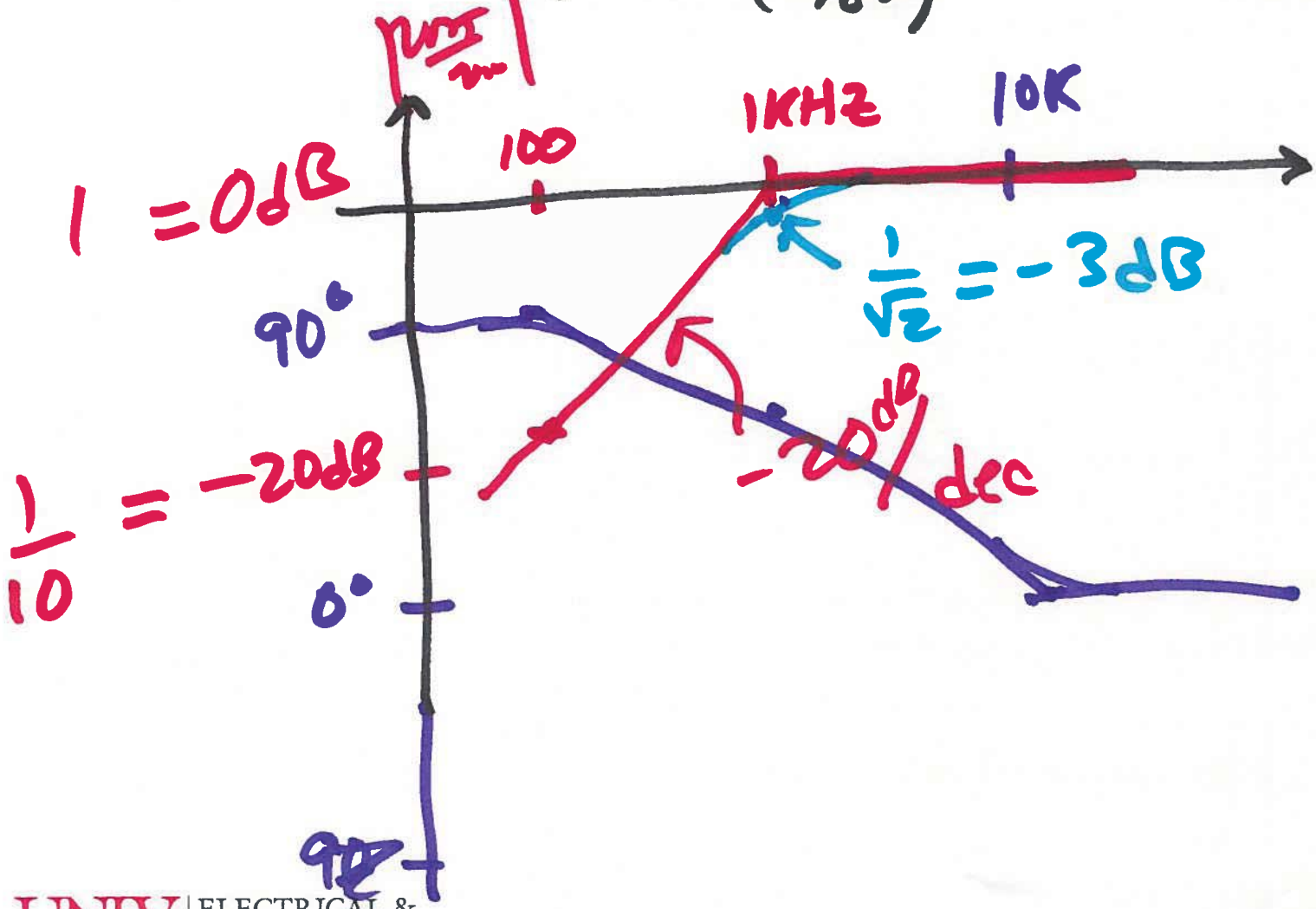
$$2\pi f \cdot RC = \frac{f}{x}$$

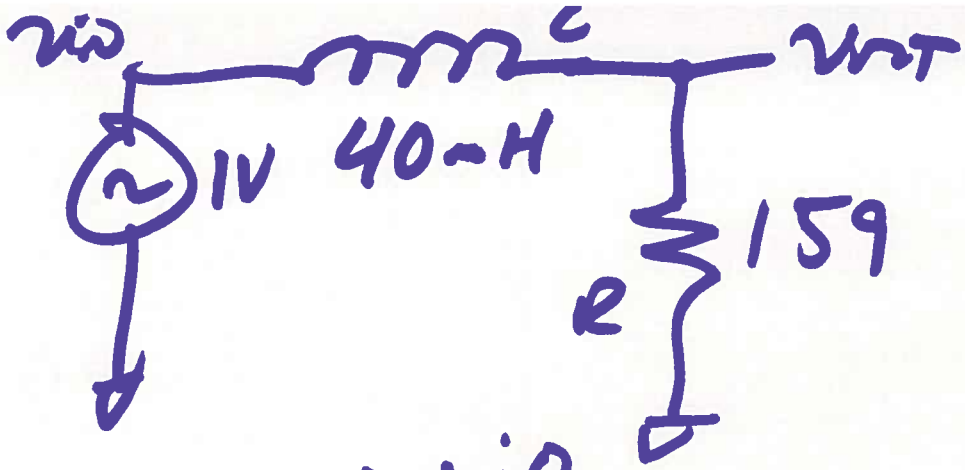
$$\text{let } x = \frac{1}{2\pi RC}$$

2)

$$\left|\frac{V_{out}}{V_{in}}\right| = \frac{\frac{f}{10^3}}{\sqrt{1+\left(\frac{f}{10^3}\right)^2}}, \quad \angle \frac{V_{out}}{V_{in}} = 90 - \tan^{-1}\frac{f}{1000}$$

$20 \log 1 = 0\,dB$





$$\frac{v_{out}}{v_{in}} = \frac{R + j\cdot 0}{R + j\cdot 2\pi f \cdot L} = \frac{1 + j0}{1 + j\cdot 2\pi f \cdot \frac{L}{R}}$$

$$= \frac{1 + j0}{1 + j\frac{f}{K}}$$

let $K = \frac{1}{2\pi \frac{L}{R}}$

$$= \frac{1}{2\pi \cdot \frac{0.04}{159}}$$

$$= 632\ Hz$$

$$= \frac{1 + j0}{1 + j\frac{f}{632}} \cdot \frac{100}{100}$$

$$= \frac{100 + j0}{100 + j\frac{f}{6.32}}$$

$$\left|\frac{v_{OT}}{v_{in}}\right| = \frac{1}{\sqrt{1+\left(\frac{f}{632}\right)^2}}$$

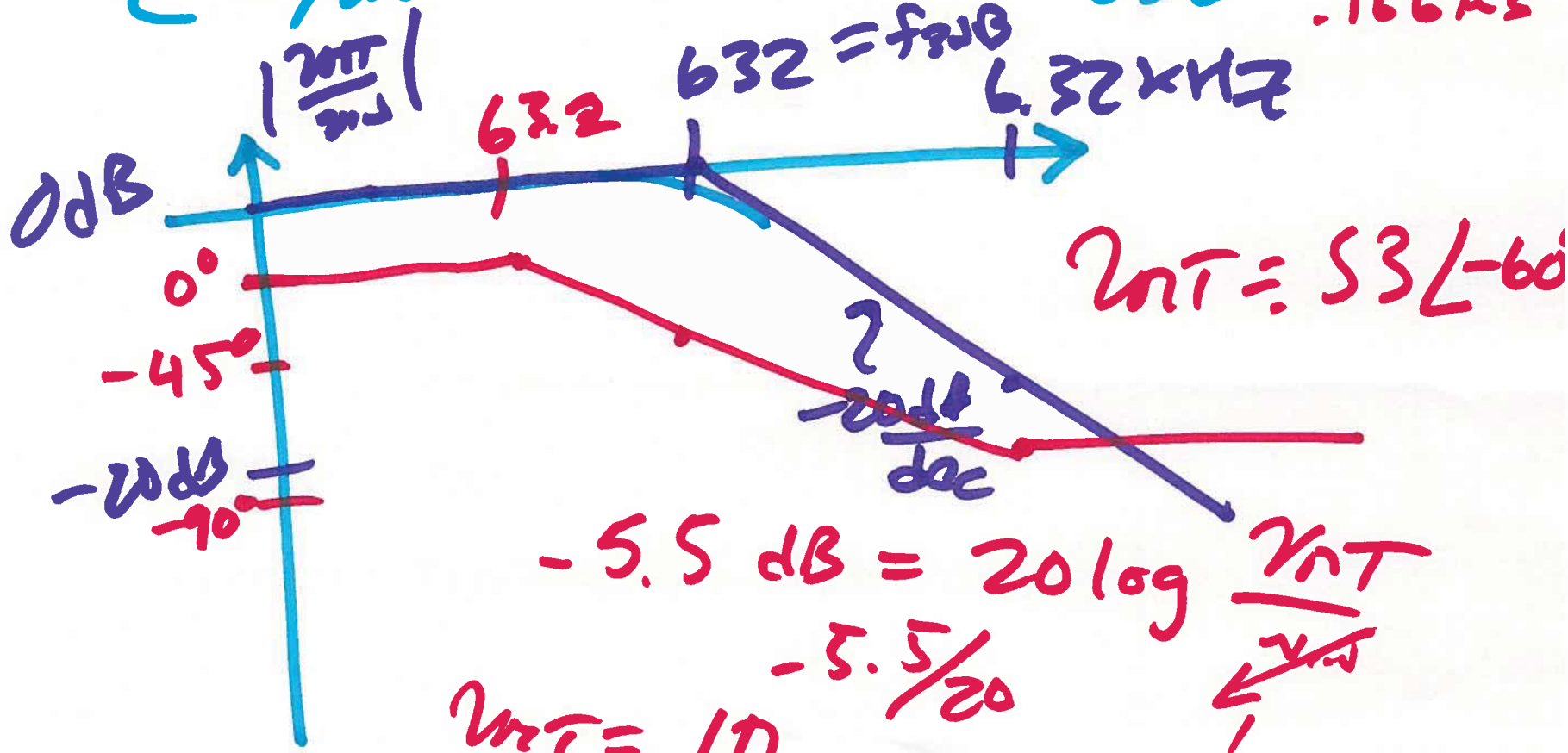
$$-60 = 360 \cdot \frac{t_d}{1ms}$$

$$\frac{1}{6}ms = t_d$$

.167 ms

.166 ms

$$\angle v_{OT}/v_{in} = 0 - \tan^{-1}\frac{f}{632}$$



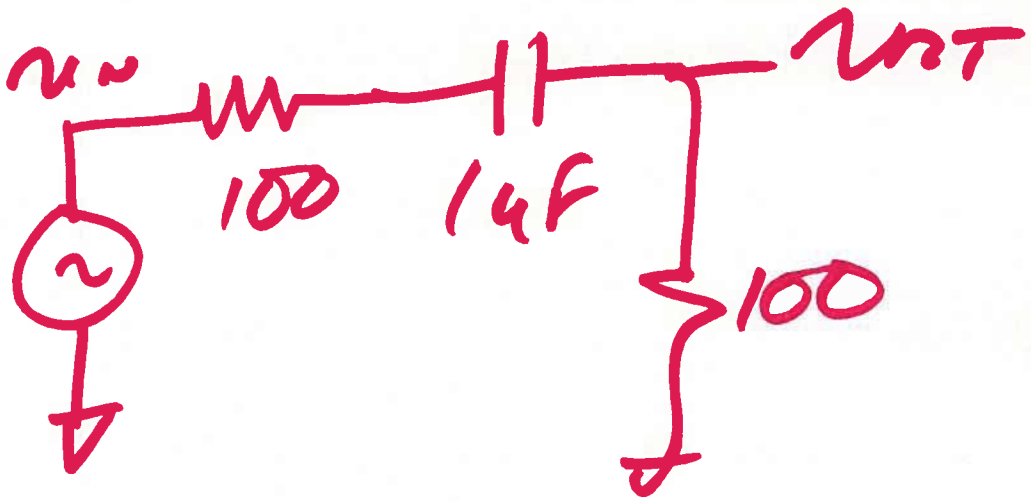
$$v_{OT} \doteq 53\angle -60$$

$$-5.5\ dB = 20\log\frac{v_{OT}}{v_{in}}$$

$$-5.5/20$$

$$v_{OT} = 10$$

$$v_{OT} = .53$$



$$f_p = \frac{200}{4\pi \cdot 10^{-4}} \approx 159\ \text{kHz}$$

$$200 = 2\pi f_p \cdot 10^{-4} \cdot 2$$

$$v_{out} = v_{in} \cdot \frac{100}{100 + 100 + 1/j\omega 10^{-6}}$$

$$\frac{v_{out}}{v_{in}} = \frac{0 + j \cdot 2\pi f \cdot 10^{-4}}{200 + j \cdot 2\pi f \cdot 10^{-4} \cdot 2}$$