ECE 182 Lab #1 Instruments and Transients
Day of Submission:09/05/2025
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Circuit Design and Schematic
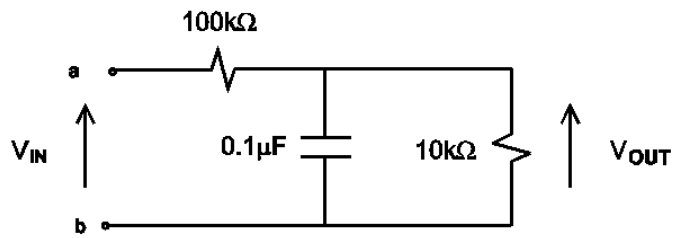

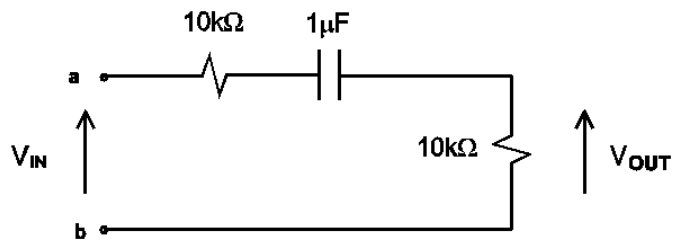**Fig. 1**

Fig. 2

Fig. 1
- Theoretical vs Experimental Value
- 100kohm = 98.123kohm
- 10kohm = 9.857kohm
- 0.1 microfarad = 0.0992 microfarad

Fig. 2
- Theoretical vs Experimental Value
- 10kohm = 9.857kohm
- 10kohm = 9.857kohm
- 1 microfarad = 0.9709 microfarad

Equations for Theoretical Basis
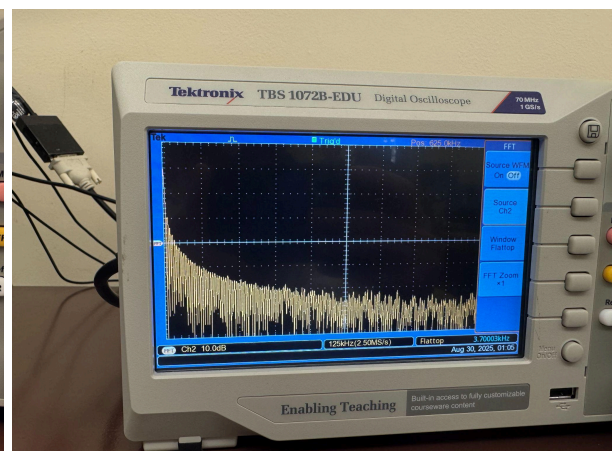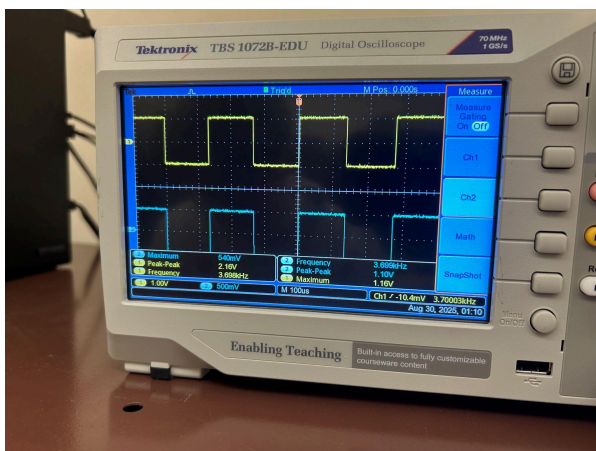
$$V_n(t) = V_f + (V_0 - V_f)e^{-t/\tau}$$
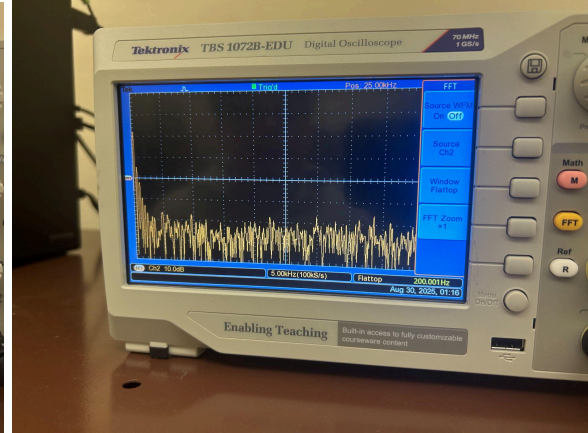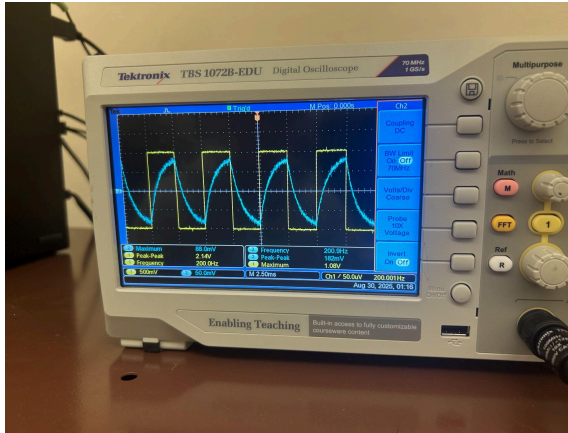
Results and Calculations
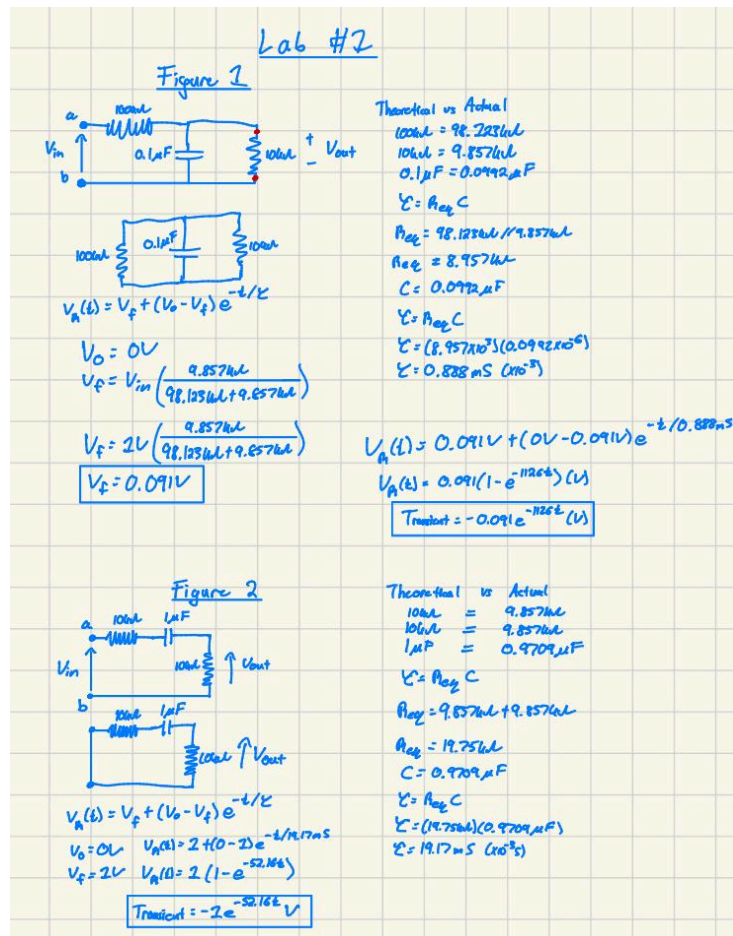
Figure 1 and 2 Circuits on Breadboard
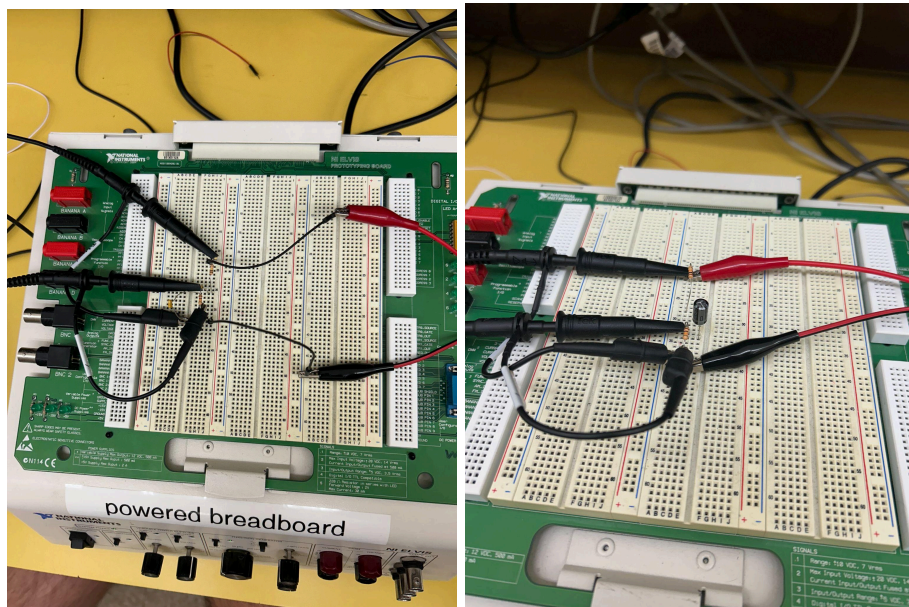
Left Image: Yellow Wave: Input, Blue Wave: Output. Right Image: FFT
Figure 1

Left Image: Yellow Wave: Input, Blue Wave: Output. Right Image: FFT
For Figure 2

Calculations for Figure 1 and 2

Lab #2

Figure 1

Theoretical vs Actual
$100k\Omega = 98.123k\Omega$
$10k\Omega = 9.857k\Omega$
$0.1\mu F = 0.0992\mu F$

$\tau = R_{eq} C$

$R_{eq} = 98.123k\Omega // 9.857k\Omega$

$R_{eq} = 8.957k\Omega$

$C = 0.0992\mu F$

$\tau = R_{eq} C$

$\tau = (8.957 \times 10^3)(0.0992 \times 10^{-6})$

$\tau = 0.888 \, mS \, (\times 10^{-3})$

$V_A(t) = V_f + (V_0 - V_f)e^{-t/\tau}$

$V_0 = 0V$

$V_f = V_{in}\left(\dfrac{9.857k\Omega}{98.123k\Omega + 9.857k\Omega}\right)$

$V_f = 1V\left(\dfrac{9.857k\Omega}{98.123k\Omega + 9.857k\Omega}\right)$

$\boxed{V_f = 0.091V}$

$V_A(t) = 0.091V + (0V - 0.091V)e^{-t/0.888mS}$

$V_A(t) = 0.091(1 - e^{-1126t}) \, (V)$

$\boxed{Transient = -0.091e^{-1126t} \, (V)}$

Figure 2

Theoretical vs Actual
$10k\Omega = 9.857k\Omega$
$10k\Omega = 9.857k\Omega$
$1\mu F = 0.9709\mu F$

$\tau = R_{eq} C$

$R_{eq} = 9.857k\Omega + 9.857k\Omega$

$R_{eq} = 19.756k\Omega$

$C = 0.9709\mu F$

$\tau = R_{eq} C$

$\tau = (19.756k\Omega)(0.9709\mu F)$

$\tau = 19.17 \, mS \, (\times 10^{-3}s)$

$V_A(t) = V_f + (V_0 - V_f)e^{-t/\tau}$

$V_0 = 0V$ $V_A(t) = 2 + (0 - 2)e^{-t/19.17mS}$

$V_f = 2V$ $V_A(t) = 2(1 - e^{-52.16t})$

$\boxed{Transient = -2e^{-52.16t} \, V}$

<u>Summary</u>

I built and tested Figure 1 (Low Pass Filter) and Figure 2 (High Pass Filter) with the input square waves and recorded output waves. I also recorded the FFT (Fast Fourier Transform) of both circuits to compare the theory and measured values. With all of the data gathered I used the equation (above) to calculate the transient of both circuits. Overall the theoretical values I calculated were very similar to the FFT's that I captured with only minor discrepancies due to equipment error.