ECEN 214 - Lab Report

Lab Number: 7

Lab Title: AC Response of a 1st Order RC Circuit

Section Number: 502

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Introduction:

In this lab, we were prompted to learn more about the response of a 1st order circuit to various periodic inputs. This was done by changing the theory within the lab manual by making a triangular wave into a 1st order RC low pass. We continued to do this for triangular, square and sine waveforms.

Task 1:

Task one consisted of building the circuit within figure 7.3 within the lab manual. To do this, we used a resistor with 15.1 kΩ and the capacitor with 10 nF. This created once over resistor times capacitor to equal 2000π.We then created a triangle waverorm with a peak to peak of 2 volts and frequency of 250 Hz. After we record the input frequency.

Task 2:

Task two consisted of following the same procedure as task one, except creating a square waveform instead of a triangular waveform. We then ran the square waveform with the back to back 1st order filter and make the cutoff frequency to 1 kHz. After, the cutoff frequency and input frequency was recorded.

Task 3:

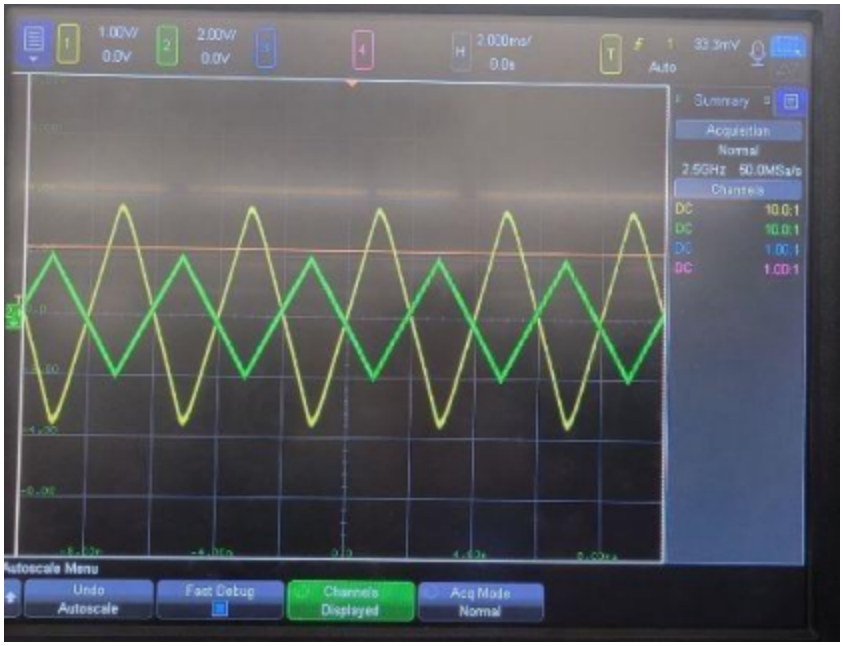
Task three consisted of building circuit 7.5 from the lab manual. Once this was done, R1 and C1 equaled 250 Hz. We also make the 10kΩ potentiometer equal to 5kΩ even. After that we made a triangular waveform and recorded its frequency and voltage division.

Measured Data & Waveforms:

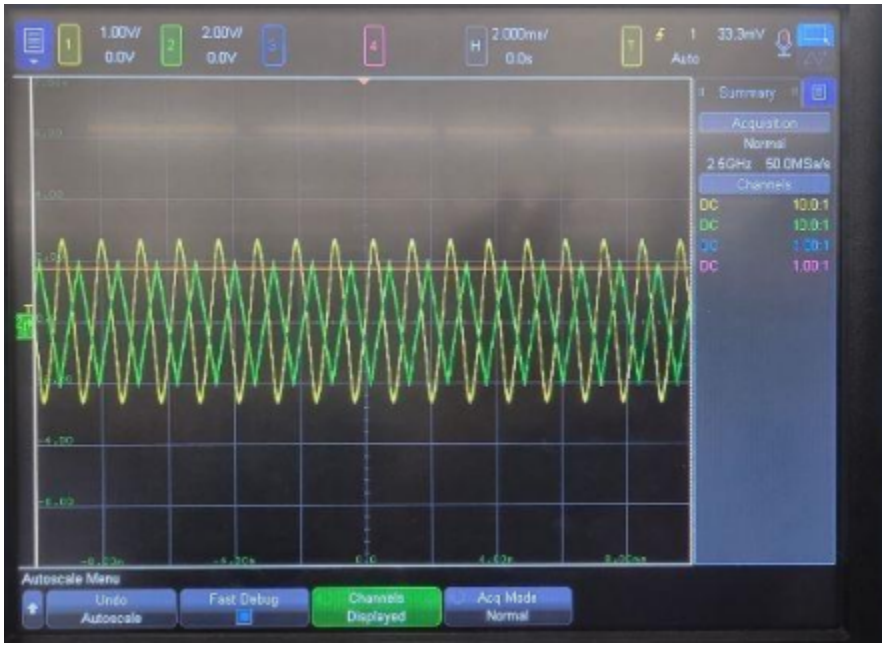
Task 1:

Input = Green Output = Yellow

R= 15.1 kΩ
C = 10nF
Input Frequency = 850 Hz



Waveform 1: Triangle Waveform



Waveform 2: Triangle to Sinusoidal

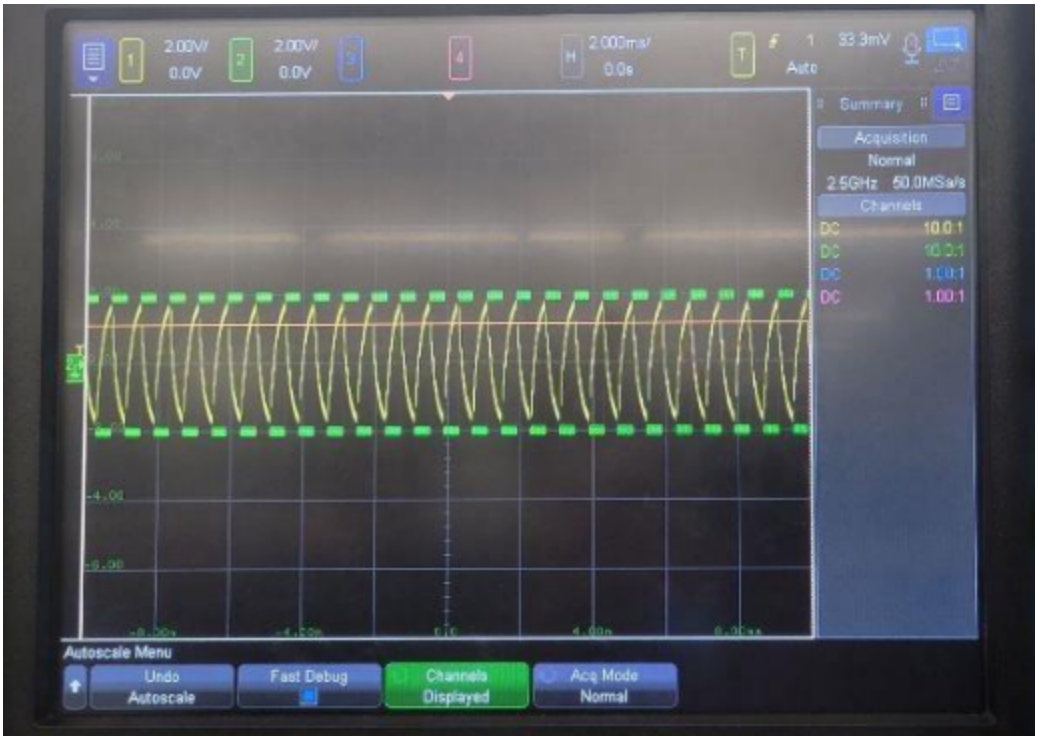
Task 2:

$R_1 = 15.1k\Omega \quad R_2 = 5.1k\Omega$

$C_1 = 10nF \quad C_2 = 39nF$

Input Frequency = 1.25 kHz

Cutoff Frequency = 1 kHz



Waveform 3: Square at 1.25 kHz

Waveform 4: Square at 250 Hz

Waveform 5: Square to Sine (Cutoff)

Task 3:

$R_1 = 200\ k\Omega \quad R_2 = 100k\Omega$

$C_1 = 10nF \quad C_2 = 10nF$

$Frequency = 1.5\ kHz$

$V_1 = 670mV \quad V_2 = 1.24V \quad V_4 = 2.34V$

Waveform 6: Triangle Waveform

Waveform 7: Square Waveform

Waveform 8: Sine Waveform

Sample Calculations:

The only calculations were within the prelab when calculating output voltage and RC values.

$$V_{in}(t) = A\cos(\omega t + \Theta)$$

$$V_{out}(t) = \frac{A}{\sqrt{1+(\omega RC)^2}}\cos(\omega t + \Theta - \tan^{-1}(\omega RC))$$

Discussion:

Overall, the graphs were as expected, however if there were any differences, it would be due to the components. Some of the components were faulty, so we had to switch them out for new components. The lab however was still a success in matching the expected values and graphs.