Lab 7: AC Current and Lighting
Author: Shaaz Feerasta
CCID: feerasta
Student ID: 1704756
Lab Partner(s): Morgann Reinhart
PHYS 126, LAB HR81
TA: Nicolas Concha Marroquin
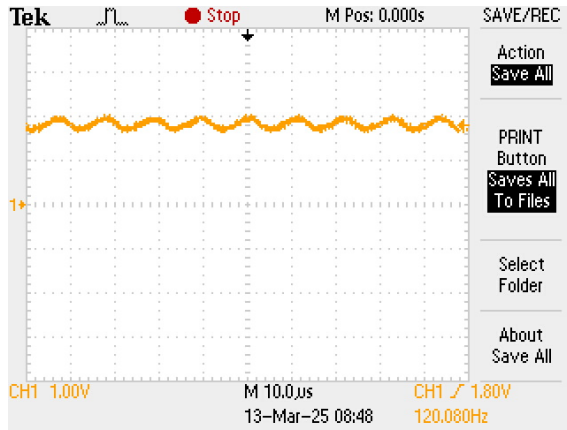Date of Lab: March 13, 2025

1 Plots

Figure 1: Wavelength of CFL 1 Bulb (X-axis: Time in milliseconds, Y-axis: Voltage in volts)
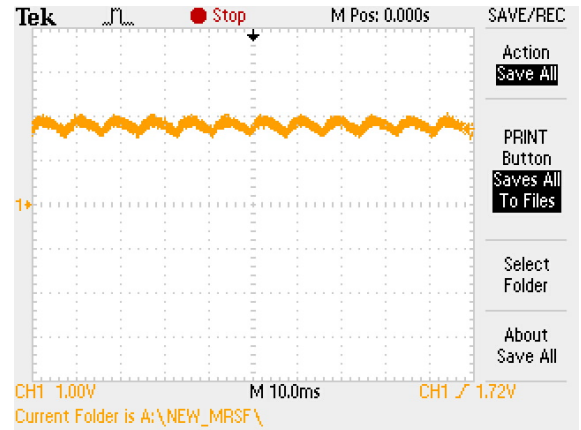
Figure 2: Wavelength of CFL 2 Bulb (X-axis: Time in milliseconds, Y-axis: Voltage in volts)
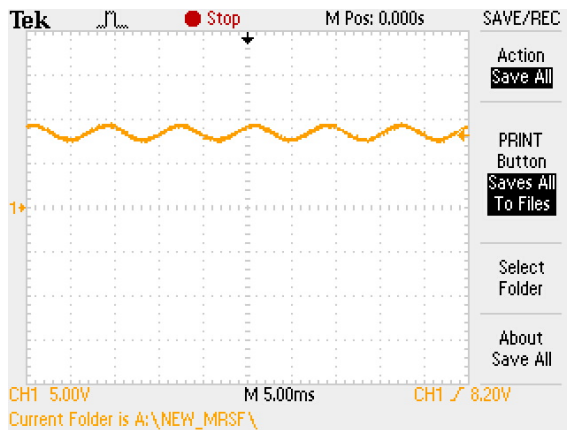
Figure 3: Wavelength of Incandescent Bulb (X-axis: Time in milliseconds, Y-axis: Voltage in volts)
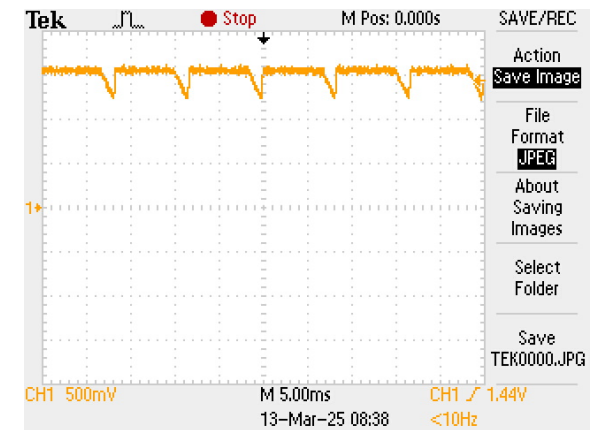
Figure 4: Wavelength of LED Bulb (X-axis: Time in milliseconds, Y-axis: Voltage in millivolts and volts)

2 Incandescent Frequency

We know that $f = 1/T$, and from our collected data, one wave completes in around 0.008 seconds. So, our calculated frequency becomes ≈ 125 Hz. As for our expected frequency, we know that $V = V_0 \sin(\omega t)$. So,

$$V^2 = V_0^2 \sin^2(\omega t) = V_0^2 \frac{1 - \cos(2\omega t)}{2} = V_0^2 \frac{1 - \cos(2(2\pi f)t)}{2} = V_0^2 \frac{1 - \cos((2\pi 2f)t)}{2}$$

We see that our frequency doubles when we square our voltage. Since $P \propto V^2$, for $f = 60$ Hz, our expected frequency would be ≈ 120 Hz, which agrees with our experimental frequency.

1

3 DC Offset

There does indeed seem to be a DC offset based on the graph above. We don't really want it to ever reach 0 V, as that means that there is no voltage going to the bulb, and it would just turn off or dim, and so we need the DC offset.

4 Tungsten

Tungsten was chosen due to its high electrical resistivity and high melting point. Meaning, it effectively converts the electricity to heat, and doesn't melt either while also resisting high temperatures.

5 LED Frequency

Our measured frequency ended up being ≈ 100 Hz when calculating using the frequency formula. Using the methods above, we expect our frequency to be around 60 Hz, and so our numbers do not agree. Our voltage does not approach zero here either for the same reasons mentioned previously. Further, the way LED bulbs work is that it tries to avoid the bottom half of the frequency wave, and if it doesn't go to 0 V, the technology is doing a good job.

6 CFL Frequencies

One of our frequencies for the CFL Bulb was ≈ 91575 Hz. The other measured frequency was ≈ 113 Hz. Both frequencies dip a little towards zero, but none of them actually go to 0 V, based on the graphs.

7 Steady Output

Comparing all the graphs, it seems the most steady bulb is the LED bulb. It drops much less often than the other bulbs, but also shoots back up nearly instantly. It seems to be the most consistent and steady bulb out of all the ones we have experimented with.

References

[1] Department of Physics. *PHYS 126 Lab Manual*. University of Alberta, 2025.

[2] TA assisted with the lab, and provided guidance on the data collection and analysis.

[3] Lab partner Morgann Reinhart assisted with the data collection and analysis.