ECE401 – Perspectives in Electrical and Computer Engineering

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Taking measurements with the Oscilloscope and building a Linear Power Supply

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LAB Section: 05

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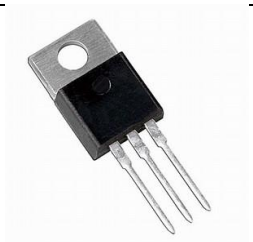
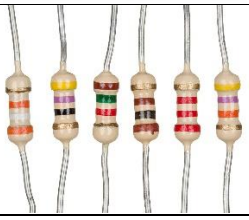
Introduction:

Lab 4 is titled “Taking measurements with the Oscilloscope and building a Linear Power Supply” and its objective is just that. For this lab, I designed and created many forms of a linear power supply. I checked that each circuit was correct with the TA, then hooked up an oscilloscope to display its waveform. This lab is essential because it teaches the student how each component can affect the output of a given circuit.

Equipment list:

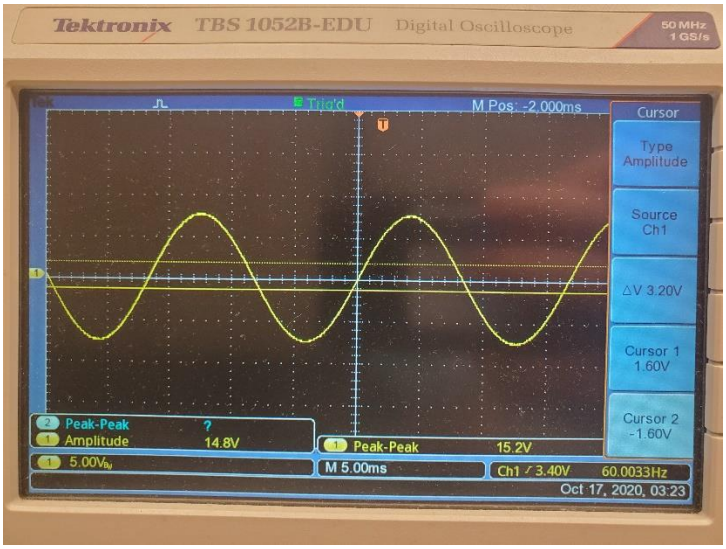
Equipment	Image	Description
Center Tapped Transformer		A variation of a classic transformer that varies by adding a third wire to the output that always will have a negative charge. Used in AC to DC applications such as full-wave rectifier.
1N4001 Diode(s)		A diode commonly found in AC to DC adaptors.
2200 µF Capacitor		A small electrolytic capacitor that temporarily store voltage in an electrical circuit.
MCC 7805CT Voltage Regulator		A three-lead voltage regulator that allows only a certain voltage to pass through a circuit.
Load Resistor (resistance will vary)		A simple resistor that will be measured to output a signal on an oscilloscope.

Oscilloscope		An oscilloscope provides a graph of voltage in relation to time. This allows the observer to see how the voltage changes over time. This is most useful when dealing with periodic waveforms
Digital Multimeter (DMM)		An electronic instrument used to measure electric voltage, current and resistivity. Multimeters provide the ability to measure different electrical signals as opposed to using individual meters.
Banana Jumper Cables		A pair of wires connected to conductive clips to temporarily join electrical equipment. They are used in conjunction with an oscilloscope and DMM to measure electrical signals.

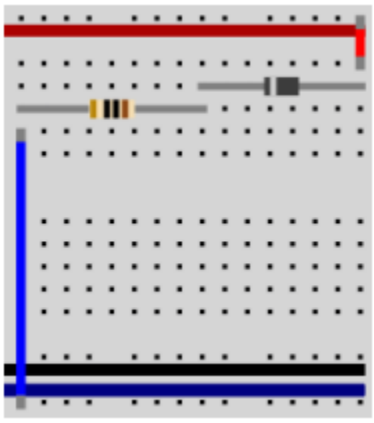
Procedure:

First, I will detail the steps I took to create a Half-Wave Rectifier, then a Full-Wave Rectifier with Smoothing Capacitor, and lastly a Bridge Rectifier with Smoothing Capacitor and Voltage Regulator. To measure the resulting waveform, I always put the test leads on either side of the resistor.

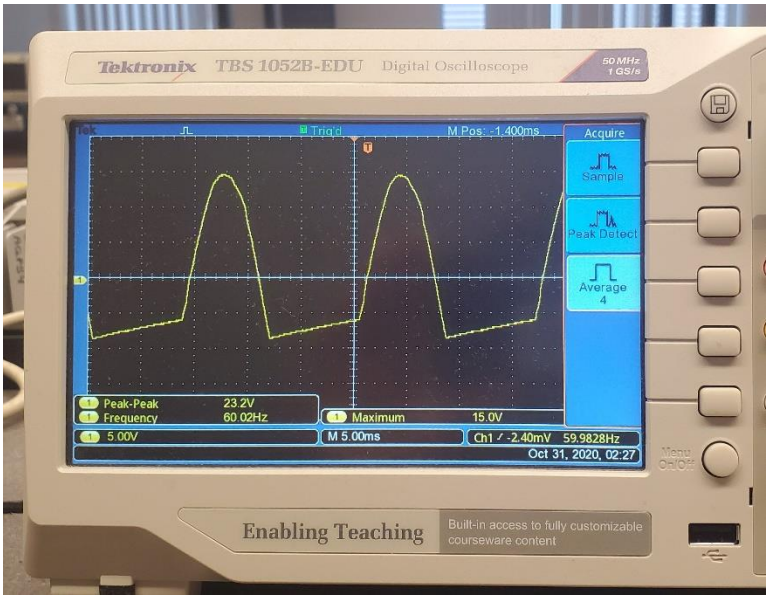
1. The waveform I started with is an 8V AC sinusoidal wave from the wall outlet. It looked like what is below. The measurements of this specific wave are incorrect, but the general shape is the same as what came from the wall outlet.



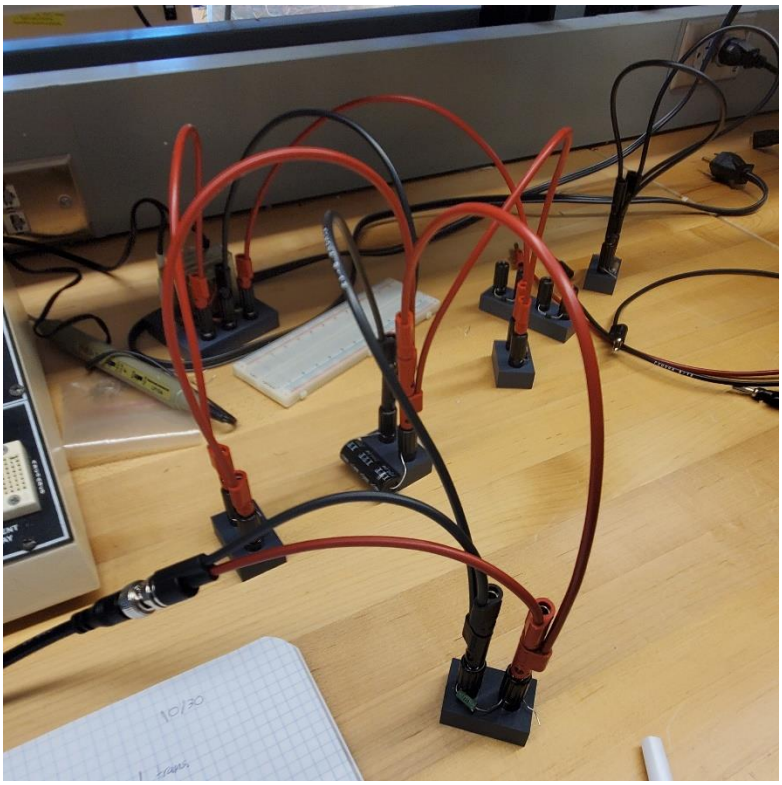
2. For the Half-Wave Rectifier, I forgot to take a picture of what the circuit I made looked like, but it is like the configuration a designed from my pre-lab.



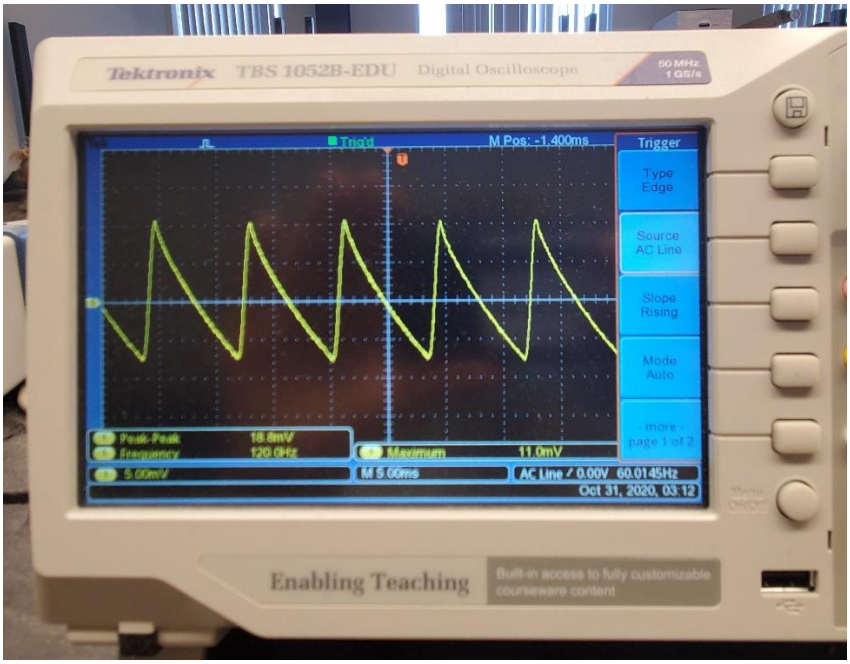
3. After I turned on the oscilloscope and plugged in the transformer to the wall, the display from the oscilloscope looked like what I had predicted in the pre-lab.



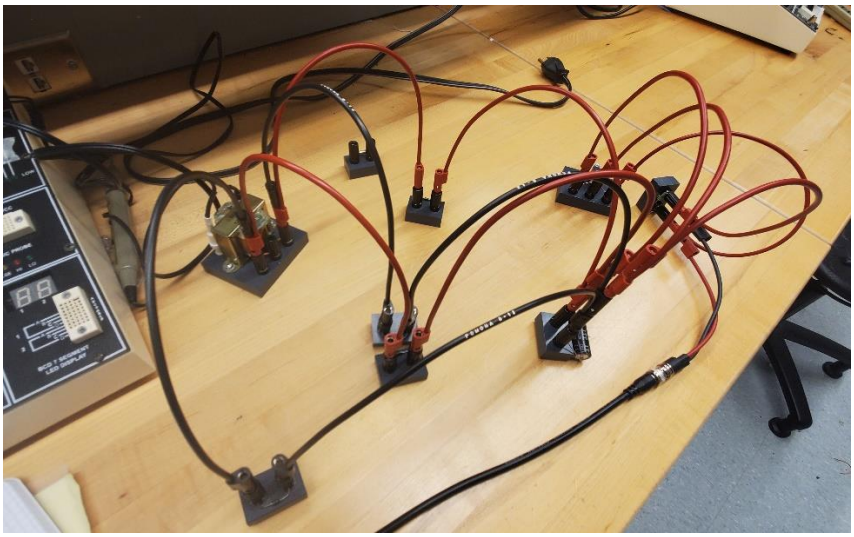
4. Next was the Full-Wave Rectifier with Smoothing Capacitor. My design is the same as the one I made in the pre-lab.



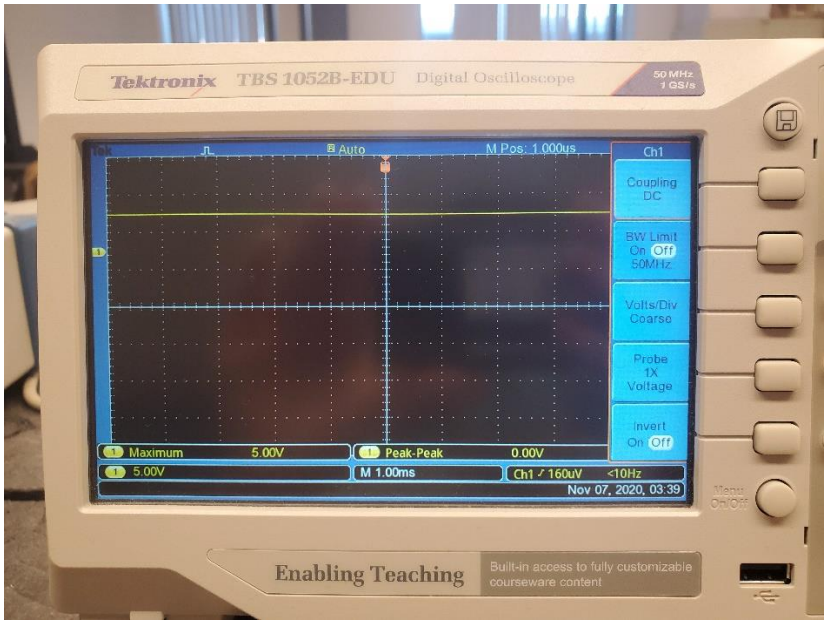
5. For some reason, I did not get the desired output from oscilloscope as I predicted in the pre-lab. This erroneous signal resembled a reverse sawtooth wave.



6. Making the Bridge Rectifier was the most difficult and had the most complex design.

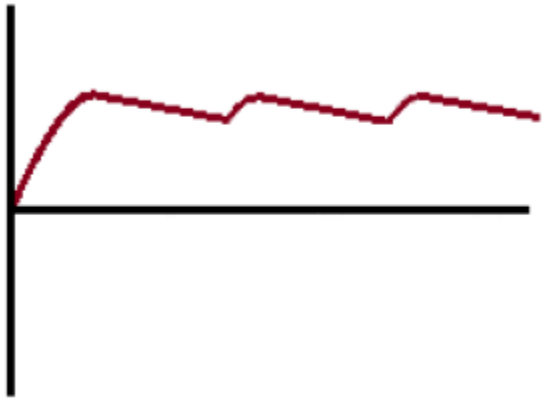


7. The output from the oscilloscope had the desired outcome. It showed a unipolar DC wave at 5 volts.



Results/Discussion:

Most of what I predicted was correct in that what I predicted in the pre-lab was for the most part the same as what I saw on the oscilloscope. As I said earlier, I did run into an issue with waveform of the Full-Wave Rectifier with Smoothing Capacitor. It produced a reverse sawtooth wave instead of the wave I predicted. What I predicted it to look like is this:



During lab I also found that at one point the test leads were not fully inserted into to oscilloscope. I noticed this after I plugged in the transformer and saw almost no change In the oscilloscope display. I fixed this by reattaching the RG6 cable to the oscilloscope and twisting the end to make sure it was locked in.

Conclusion:

I believe this lab was successful in teaching me to build many designs for linear power supplies. I now believe that I know how each component can affect the output of a given circuit. I had not used a transformer, capacitor, or voltage regulator before this lab. Though I did run into a few issues with the oscilloscope, it did not slow me down in completing the other tasks of the lab on time. If I were able to do this lab again, I would try to remember to take more pictures of the circuit configurations and oscilloscope display.