Laboratory No. 3:
Zener Diode Lab

By: Derek Hildreth

Instructor: Brother Fisher

BYU-Idaho CompE 350

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I. INTRODUCTION

A. Purpose

The objectives in this laboratory are to

1. Become familiar with power supply regulation.

2. Practice measurements and calculations for a regulated power supply.

3. Observe the effects load resistance on parallel voltage regulation (zener diode) and series voltage regulation (IC regulator).

B. Equipment

- Diode: 1N4007

- Zener Diode: 12V

- Capacitor: $200\mu F$

- 12V Rectifier (7812)

- Resistors: 1kΩ (For R_ Load), 200Ω (For R_ Series)

- Digital Voltage Meter (DVM)

- A circuit breadboard

- Oscilloscope

C. Procedure

1. Use only one-half of your transformers output voltage by using the center tap. Measure the output voltage of your transformer. Use this value when making your calculations.

2. Design a regulated 12 Volt power supply for a 1 kΩ load resistor using this transformer, a 12 Volt zener diode, a capacitor and a series resistor. Take care not to exceed the power rating of your series resistor!

3. Calculate the peak voltage and ripple voltage across the rectifier output (filter capacitor).

4. Calculate the effective voltage and ripple voltage across the load.

5. Measure the peak voltage and ripple voltage across the filter capacitor.

6. Measure the effective voltage and ripple voltage across the load.

7. Repeat steps 2 through 6 using a 7812 voltage regulator instead of a zener diode. Recall that no series resistor is necessary with the IC regulator. Compare the results of the two circuits.

II.   SCHEMATICS

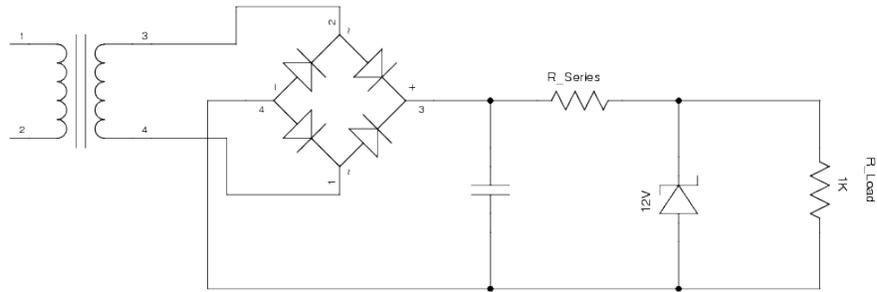This section will consist of the schematics that were used in this lab.

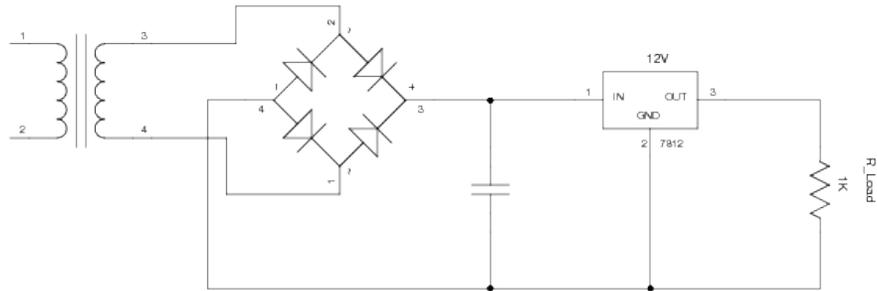FIG. 1: A schematic of a 12V power supply using a Zener Diode.

FIG. 2: A schematic of a 12V power supply using a Voltage Regulator.

III. EXPERIMENT DATA

This section consists of both the expected and measured experiment results of the zener and regulator power supplies. Refer to Table I below for results.

	Zener Diode Design			
	Load		Filter Cap.	
	Effective (V)	Ripple (mV)	Peak (V)	Ripple (mV)
Calculated	12.00	53.8	18.60	1.25
Measured	11.86	80.0	17.37	1.01
	Regulator Design			
	Load		Filter Cap.	
	Effective (V)	Ripple (mV)	Peak (V)	Ripple (mV)
Calculated	12.00	53.8	18.40	0.492
Measured	11.95	80.0	17.63	0.660

TABLE I: Calculated and measured results of both power supply designs

IV. CONCLUSION

For this laboratory, it was important to compare what was calculated and what was measured and explain any discrepancies. For the most part, the calculations and measurements were pretty close in this exercise. There were some discrepancies with the measurements in the voltage regulator design. The calculations were done by using a 100μF capacitor and the measurements were taken using a 220μF capacitor, so the differences between the two were off a bit.

Again, in this lab, there were two different kinds of power supplies built: one built with a zener diode, and the other built with a voltage rectifier. Each has it's own advantages and disadvantages. The design with the zener diode might be cheapter to build and run cooler than the one with the voltage rectifier, but it can't have a load below or above a certain amount of ohms (specifically no less than 158Ω). The voltage regulator can be connected and disconnected easily and can supply voltage to a load or no load. It may be more expensive to produce because of the 7812 unit.

Overall, this laboratory was pretty straight forward and didn't contain any tricky spots. For myself, it was a little difficult to calculate some of the values at first but once I got the hang of it, things came pretty quickly. What I would like to work on for future lab exercises is to actually prepare and study prior to stepping into the lab, knowing how to quickly calculate various circuits.