

Zener Regulators

In this lab you will construct a regulated DC power supply. You will observe the behavior of the circuit as a function of load current.

Equipment

1. Transformer
2. Oscilloscope

Materials

1. (4) 1N4002 Diodes
2. 10 μF Capacitor
3. 1N5230 Diode (Zener)
4. (2) 1 $\text{k}\Omega$ Resistor
5. (1) 680 Ω Resistor

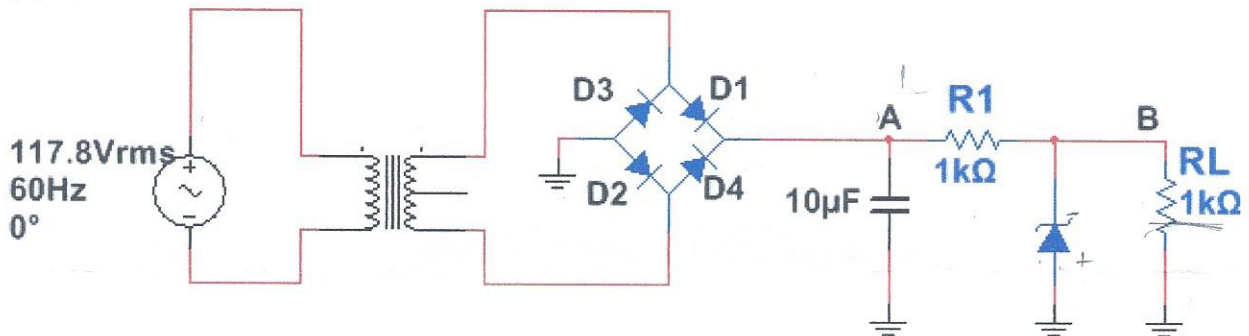


Figure 3-1

Procedure

1. Open Multisim (draw the circuits) and Benchvue (take the screenshots)
2. Measure all (3) resistor values and record them.
 $R_1 = 0.9843 \text{ k}\Omega$ $R_{L1} = 0.9842 \text{ k}\Omega$ $R_{L2} = 0.6811 \text{ k}\Omega$
3. Configure the circuit in Figure 3-1 above.
4. Measure the secondary voltage. Record the rms or peak voltage. $V_{\text{sec}} = 14.60 \text{ V}$
5. Determine the turns ratio of the transformer. $n =$ _____
6. Use the oscilloscope to measure the max and min of the ripple voltage (Point A) of the filter (Channel 1) and the max and min output voltage (Point B)(Channel 2). Take a screenshot and save.
7. Calculate the **peak** currents, I_{R1} , I_L , and I_Z . (Hint: Start with $I_{R1} = \frac{V_A(\text{pk})}{R_1 + R_L}$)
8. Replace R_L with the 680 Ω resistor and repeat steps 5 and 6.

Submittal:

1. **Lab Cover Sheet** (filled in appropriately)
2. **Title Page** (Appropriate information is described in the 'Format of a Technical Report' found on Blackboard)
3. **DATA** section including:
 - a. **Circuit #1**
 - b. **Circuit #2**
 - c. **1N5230 Datasheet**
 - d. Table 3-1 includes nominal and measured values of R_1 , R_{L1} and R_{L2} .
 - e. **Table 3-2** includes $V_r(p-p)$ and V_{out} when $R_L = 1k\ \Omega$ (measured quantities)
 - f. **Table 3-3** includes $V_r(p-p)$ and V_{out} when $R_L = 220\ \Omega$ (measured quantities)
 - g. **Table 3-4** includes values for I_{R1} , I_{Zener} and I_{Load} for each circuit (calculated quantities from measured Voltages and Resistances)
 - h. **Sample Calculations** includes the general format of equations used to calculate I_{R1} , I_{Zener} and I_{Load} in **Table 3-4**.
 - i. An answer to the following question: "What effect does lowering the load resistance have on the regulation of the circuit?"
4. **DISCUSSION** section – makes sure to include discussion regarding measured values compared to datasheet information.
5. **CONCLUSION** section

Hint: For a successful submittal make sure your report components are presented in the above order. This makes organized and logical sense for an explanation of data. Be sure headings are stated (for example: **DATA**) and all components of the DATA section (for example: **TABLE 3-1**) are labeled.

BONUS (10%): Simulate both circuits in Multisim and make a comparison of measured to simulated results of ripple voltage and regulated output voltage.