**Lab 1: Linear Voltage Regulator**

**Your Name**

Your Major

Your Minor or Second Major (if applicable)

**0. ABSTRACT**

This is the template for your lab report. **Except for section headings (e.g. ABSTRACT), delete all instructions and replace with your own text.** Margins are 1-inch all around. Each page should have a header and page number. All text is in Times New Roman font with a line-spacing of 1.5. The title is bold-faced, 18 pt, and centered. The main body text is in 11 pt font. The author entry is bold-faced and centered. The abstract should be relatively short (e.g. seven lines or so). Summarize the goals of your lab work. The last sentence or two should describe your opinion on how you benefited from the lab (e.g. working with heat sinks).

**1. INTRODUCTION**

Your lab report should tell a story about your experience with linear voltage regulators. To start things off, this section is where you describe why voltage regulators are important to the survival of humankind. OK, you don’t have to be that dramatic, but **this section should give the reader an idea of (1) why voltage regulators are important and (2) how they work**. Make sure to describe the basic components of a linear voltage regulator. Spend 2 to 3 sentences EACH on the voltage reference, pass transistor, etc. This section should not be too long (e.g. roughly one page).

**2. ZENER FOLLOWER**

**2.1 Circuit Design**

Include a circuit diagram of the Zener follower circuit (e.g. Fig. 1 from Lab 1a handout), and make sure to clearly describe the load parameters. Summarize the design steps (i.e. from Lecture 01 notes) to select the various components (including the heat sink). For each component, type one or two formulas and explain the strategy (e.g. provide at least 10 mA to the Zener) used to choose the component value (and power rating, if applicable).

**2.2 Results and Analysis**

Gathering results is obviously important, but an engineer must be able to take a step back and think about the results (do they make sense, what they mean, etc.). **Your report will NOT include every single result from the lab activity**. This means you do NOT necessarily need to include the same tables from the lab handout. For example, Table IV from Lab 1a includes base current and current gain, but you won’t need those for this report. Only include the measurements that help describe a reasonably coherent story. Briefly describe what you did (e.g. how you made measurements), the results, and a short analysis (e.g. 30% efficiency is not that impressive) for the following:

* Line regulation of the Zener diode by itself
* Efficiency of the Zener follower

**3. ZENER FOLLOWER WITH FEEDBACK**

**3.1 Circuit Design**

Include a circuit diagram of your Multisim circuit (e.g. Task 2 of Prelab 1). Briefly explain the purpose of the op amp and voltage divider. How does the load regulation of the simulated circuit compare to your measurements from Lab 1a?

**3.2 Results and Analysis**

Briefly describe what you did (e.g. how you made measurements), the results, and a short analysis (e.g. op amp dramatically improves load regulation) for the following:

* Line regulation
* Load regulation

**4. FIXED VOLTAGE REGULATOR IC**

**4.1 78L05 Regulator IC**

Briefly describe the voltage output and current capability of the 78L05, as well as the various internal protection circuitry.

**4.2 Results and Analysis**

Include a circuit diagram (e.g. Fig. 4 from Lab 1b handout) of your 78L05 circuit. Briefly describe what you did (e.g. how you made measurements), the results, and a short analysis (e.g. how the 78L05 load regulation compares to the Zener follower with feedback) for the following:

* Line regulation
* Load regulation
* Thermal shutdown experiment

**5. ADJUSTABLE REGULATOR IC**

**5.1 LM317 Regulator IC**

Briefly describe how the LM317 produces the desired voltage output. Include the circuit diagram (e.g. Fig. 5 from Lab 1b handout). Explain how the 1 kohm resistor and 1 kohm potentiometer are used to achieve the desired 12V output. Also explain why a heat sink is needed.

**5.2 Results and Analysis**

Briefly describe what you did (e.g. how you made measurements), the results, and a short analysis (e.g. sufficiently large Cout is really important) for the following:

* Scope snapshot of VOUT with the fan (Cout = 1 uF)
* Scope snapshot of VOUT with the fan (Cout = 470 uF)

**6. DISCUSSION**

* Were there any strange results, circuit behavior, or finicky test equipment?
* Lab 1b was clearly too long (sorry about that ☹). Buma is thinking about replacing the last part (LM317 adjustable regulator chip) with a fixed 12V regulator chip to shorten the circuit building time. Would you agree with this change? Are there any other changes you suggest?

**7. CONCLUSIONS**

Overall, did your circuits behave reasonably well? Were there significant discrepancies between experiment and simulation? What lessons did you learn about the design/testing process? Also write about any concepts or valuable lessons you learned in the lab assignment (e.g. reading data sheets, working with heat sinks).