

Lab Report and Homework Guidelines

Physics 127B Winter 2024

We will have two types of lab in Physics 127BL, one using discrete integrated circuits (“discrete labs”), and the other with a field-programmable gate array (“FPGA labs”). There will also be 4 homework assignments. All assignments will be submitted using Gradescope, as described below.

File and Student Names

When you turn in lab reports, lab notebooks, and homework assignments, the filenames must be composed of the following components, in order:

1. your last name in lowercase letters
2. an underscore
3. your 7-digit perm number
4. another underscore
5. the assignment name, for example hw1 or lab1
6. a period and the filename extension, for example .pdf

If your name is John Bardeen and your perm number is 2997924, then the files you turn in for the first lab and the first homework assignment will be named `bardeen_2997924_lab1.pdf` and `bardeen_2997924_hw1.pdf`, respectively. Please *do not* use spaces in the filenames!

Make sure your name and perm number appear on the first page of each assignment you turn in.

Discrete Labs

For each of the discrete labs, you must maintain a lab notebook in which you neatly, carefully, and continuously record your activities as you work through the exercises in the relevant section of the lab text. Mistakes in your lab notebook are expected, and commentary on these and the function of your circuits is encouraged. By the due date for the lab, you must make, with a scan or photographs, a single PDF file containing a clear, readable copy of the relevant pages of your notebook and submit it via Gradescope. The PDF file may be no larger than 10 MB. Your notebooks will serve as your reports for the discrete labs.

FPGA Labs

For each FPGA lab, you will need to submit a short report detailing your experimental procedure and results. All reports must be written and compiled in \LaTeX . Instructions for using \LaTeX , and an example file with a figure, can be found in the “Handouts” section of the course web page. Another resource for all things \LaTeX is the relevant [wikibook](#).

You can use any \LaTeX document class and package you like. One option is REVTeX, the standard for submitting papers to all journals of the American Physical Society. There are no limits or strict requirements regarding the length of your report. You can keep a logbook while you are working, but any notes you make will be for you and won’t be collected. The same applies for anything you save on your computer, so it is important that you explain everything clearly in your report.

All reports must be submitted via Gradescope as either a `.tar` or `.zip` archive file. Both the `.pdf` output and any source files (`.tex`, figures, etc.) must be included with the submission. No individual component file in the archive may be larger than 10 MB. Avoid including images with resolution greater than 1920 pixels in any dimension. Reduce resolution further if necessary.

Report Outline

Please use the following structure for your reports:

1. **Abstract:** the abstract should be one short paragraph. Briefly summarize what you did and your results. What was the main purpose of the lab, and did you achieve it? You could also elaborate, again briefly, on how what you’ve done could be used in a real application, for instance an experiment or the design of a device.
2. **Introduction and Experimental Details:** in this section you should give an overview of your design process. What steps did you take in making your program? What were the main design problems and how did you overcome them? Explain how your code works without going into all of the details. This section should be used to demonstrate your understanding of the lab. You may wish to make figures and/or include references in order to explain your concepts more clearly. This is also the section where you should answer all questions that are asked in the lab instructions.
3. **Analysis and Discussion:** explain your code in detail. How does the FPGA execute the function you want it to? Be sure to include figures of all programs/circuits you create in Quartus. If it is easier, you may wish to include all or some figures in an appendix. However you choose to organize your report, make sure all of your figures are labeled correctly and have appropriate captions. If the program you write produces complicated output, you may want to take pictures of the FPGA board to demonstrate that it functions correctly.

Style and Content Guidelines

In order to make your report look professional, you should pay attention to the following rules:

- Use only metric (SI) units.

- Plot physical quantities of interest, not readings from your meter. If you are using a diode-array spectrometer, plot wavelength, not diode number. If using a laser power meter, plot milliwatts of optical power, not millivolts of meter output. If your calibration is uncertain, say so.
- Variables representing physical quantities and constants are set in italic type: $F = ma$, not $F = ma$.
- Units are set in upright (not italic) type: 5 m/s, not 5 *m/s*.
- Use a space between a quantity and the associated units: 15.0 cm, not 15.0cm.
- In order to keep from splitting proper names and value/unit pairs at line breaks, use a ~ character to produce a non-breaking space: 1.0 m/s is written 1.0~m/s.
- Properly typeset compound units: $\text{mL}\cdot\text{mg}^{-1}\cdot\text{cm}^{-1}$,
 $\text{mL}\cdot\text{mg}^{-1}\cdot\text{cm}^{-1}$,
not mL/mg/cm. The second form is ambiguous.
- When quoting an uncertainty, place the units (with a space) after the uncertainty¹:
 15.0 ± 0.2 cm, not 15.0 cm ± 0.2.
- Properly typeset equations: Ae^{-Bx} , not $A*e^{(-B*x)}$.
- Set multi-letter subscripts in upright (roman) type: F_g or F_{gravity} (less desirable), not F_{gravity} .
 \LaTeX does not space words properly in math mode, so you must do this, for example:
 F_{gravity} , not F_{gravity} .
- When typesetting math, do this, which requires `\usepackage{amsmath}`:

$$\int \left\{ \frac{d(\text{cabin})}{\text{cabin}} \right\} = \text{houseboat}$$

`\[\int \left\{ \frac{d(\text{cabin})}{\text{cabin}} \right\} = \text{houseboat} \]`

Do not do this:

$$\int \left\{ \frac{d(\text{cabin})}{\text{cabin}} \right\} = \log(\text{cabin})$$

`\[\int \left\{ \frac{d(\text{cabin})}{\text{cabin}} \right\} = \log(\text{cabin}) \]`

- When using nested delimiters, do this:

$$\left\{ \frac{\left[\frac{f(x+2h)-f(x+h)}{h} \right] - \left[\frac{f(x+h)-f(x)}{h} \right]}{h} \right\}, \quad \text{not} \quad \left(\frac{\left(\frac{f(x+2h)-f(x+h)}{h} \right) - \left(\frac{f(x+h)-f(x)}{h} \right)}{h} \right).$$

¹Strictly speaking, you should write 15.0 cm ± 0.2 cm or (15.0 ± 0.2) cm (see, for example, A. Thompson and B. N. Taylor, *Guide for the Use of the International System of Units (SI)*, NIST Special Publication 811, 2008). So long as there is no ambiguity, however, the form suggested above is fine for this class.

- Keep the size of your report PDF file reasonable. If it exceeds 10 MB, you probably have photographs included at excessive resolution. Crop them or reduce the resolution. \LaTeX can display the image at any size you like, regardless of the resolution.

Homework

There will be 4 homework assignments given during the quarter. For each assignment, write out your solutions on paper or type them up with \LaTeX (your choice). It is almost certainly faster to write them by hand, and no preference will be given for typeset solutions. By the due date for the homework assignment, use a scan, photographs, or \LaTeX to create a single PDF file containing a clear, readable copy of your solutions and submit it via Gradescope. The PDF file may be no larger than 10 MB.

Late assignment policy

Lab reports and homework turned in up to 24 hours late will be subject to a penalty of 10% of the total possible credit for that assignment. A lab report or homework assignment turned in more than 24 hours after it is due will receive a grade of 0. All assignments must be completed to pass the class.

Requests for homework and lab due date extensions will be considered by the instructor on an individual basis, and will only be granted in the case of serious illness, death in the family, or unavoidable circumstances of similar severity. All requests must be sent directly to the instructor (not the TAs).

Submitting to Gradescope

For each assignment, compute the MD5 hash of the file you intend to turn in. This can be done with a program (such as `md5sum`) included with your operating system, or using a web-based tool. The hash will look something like this:

```
f4468281ff4beeb20de8c58dce0b6bee  bardeen_2997924_lab1.pdf
```

Next,

1. Go to `www.gradescope.com`.
2. Click on **Log In** at the upper right.
3. Click on **School Credentials** at the lower left of the popup window.
4. Use `<Ctrl>-F` or `<Command>-F` (Mac) to search for “barb” on the page.
5. Click on **University of California Santa Barbara NetID**.

6. Log in and select the appropriate course. If you are registered for the class, you have been added to the Gradescope roster using your **@ucsb.edu** email address. **If you do not see our course**, you probably already have an account associated with an address containing **umail**. In that case, **you must merge your accounts according to the instructions here**.
7. Select the correct assignment. Create a text file containing only your MD5 hash and upload that along with the archive file.