Course Information

Physics 129 Summer 2025

1 About Your Instructor

I grew up in West Lafayette, Indiana, home of Purdue University. I decided to become a physicist when I was fourteen years old, and in 1991 I graduated with a bachelor's degree in physics from the University of Chicago. By that point I was tired of the midwest, so I set out for the University of California, Berkeley, where I received my Ph.D., also in physics, in 1998. I did five years of postdoctoral research at the National Institutes of Health in Bethesda, Maryland and taught at George Washington University before joining the physics faculty here at UCSB in July 2003.

My research involves using very sensitive light detection to study the assembly and behavior of single biological molecules.

2 Contacting Your Instructor

The best ways to reach me this quarter are by email and at my office hours.

I will try to answer all email questions within no more than one day. The address you should use is `lipm1@elo.physics.ucsb.edu` . **Please use the following subject line:**

`Subject: 129L - question`

This will help me to spot important messages from you as I delete hundreds of unimportant messages from elsewhere at UCSB.

My office hours will be Mondays from 2:30–3:45 P.M. in Broida 2409.

3 Graduate Student Instructor

The physics graduate students here at UCSB are some of the best in the world. Not only are your TAs brilliant, they are eager to help you learn.

Your TA will hold "lab" sessions, during which you can ask questions about the course material. Details about these sessions and contact information for your TA can be found on the

4 Course Web Page

The course web page is located here:

http://web.physics.ucsb.edu/~phys129/lipman/

This is where all announcements, lecture videos, homework, and other course information will be posted. **I will assume that everyone has read announcements on the web page two days after I post them, so please check frequently to keep yourself well-informed.**

5 Textbooks and Materials

A list of the materials and textbooks you need to have for the course can be found here:

http://web.physics.ucsb.edu/~phys129/lipman/materials.html

The physics department will also be supplying you with a small hardware kit containing these 5 items:

1. A 16 GB flash drive
2. A set of 4 jumper wires
3. A solar cell
4. An MCP9808 temperature sensor board
5. An ADS1015 analog to digital converter board

You paid for these with your course materials fee, and they are yours to keep.

6 Course Components

- **Homework — 65% of course grade.**
  Homework will be due once a week, at 11:55 P.M. on Saturdays unless I indicate otherwise in the assignment. Assignments will be posted on the course web page. Homework turned in up to 24 hours late will be subject to a penalty of 10% of the total possible credit for that assignment. Homework turned in more than 24 hours after it is due will receive a grade of 0.

  See the Homework Guidelines handout on the course web page for more information, including the procedure for submitting your assignments.

- **Final Project — 30% of course grade.**
  You will complete a final project of your choosing during the last few weeks of the quarter. A Project Guidelines handout will be posted at the appropriate time.

- **Attendance — 5% of course grade.**
  Experience has shown that students who attend lecture are better informed and more engaged with the course. Lab attendance is optional, and will not be graded. If you are feeling sick, email the instructor before class and you will not be penalized.

7 Course Grade

Your course grade will be based on your percentage score, computed using the weights listed above. I will determine grade cutoffs based on my expectations for your mastery of the course material, historical performance of students in this class, and whether the grading was unusually lenient or harsh.

Often just after the end of a quarter, someone writes to me asking if there is any way they can do extra work to raise their grade. **Under no circumstances will there be any opportunity to**

raise your grade after the last assignment is turned in. If you want to get a good grade, start working early and set aside the necessary time to learn the material and practice your coding.

Continued on next page. . .

8 Course Content

Here is a summary, subject to change, of what I intend to cover this quarter. K&N is *A Student's Guide to Python for Physical Modeling, second edition* by Kinder and Nelson. Shotts is *The Linux Command Line, Fifth Internet Edition* by William Shotts. This summary is for a normal 10-week quarter, so during Summer Session A we will go about 1.5 times as fast.

Week	**Topics**	**Reading** (chapters)
1.	Introduction; Install and configure RPi; Password security; Python; files; binary, hexadecimal; ASCII; `cat`, `less`, `xxd`.	Shotts: 1–4, 12; K&N: 1
2.	Bash shell: basic commands, aliases, variables; control keys, job control; redirection, pipes; files, processes; permissions; text editing; storage devices; shell scripts.	Shotts: 5–7, 15, 18, 24; K&N: 2
3.	Machine code, assembly, compilers, interpreters; Python scripts; commenting code; variables, types; print formatting; using libraries; Python help; programming fundamentals.	Shotts: 8–9, 17, 28, 32; K&N: 3
4.	Calculations in Python; names, objects, scoping; error handling; array manipulation; dictionaries; debugging; process control; links; code optimization	Shotts: 10–11, 19, 21; K&N: 4, 6.1, 10.1.1
5.	Software package managers; command line arguments; operator precedence; NumPy arrays; plotting; raster graphics; FIFOs and stacks; PostScript, PDF, and vector graphics.	Shotts: 20; K&N: 8.1–8.2, Appendix F
6.	Network protocol stack; Internet protocol; DNS; networking utilities; network services; sockets, network programming.	Shotts: 16 K&N: 6.4
7.	Classes; generators; serial communication; data acquisition; analog to digital conversion, sampling; Fourier analysis.	K&N: 10.1.3, 10.4
8.	Random number generators; Monte Carlo techniques; LaTeX; `fork()`, threading; system call tracing.	K&N: 6.2–6.3, 6.5–6.9
9.	Binomial processes; Poisson processes; nonuniform random numbers; Gaussian distribution; discrete integration.	None
10.	Numerical solution of differential equations: first- and second-order finite differences for ODEs; PDEs and 2-d finite differences; relaxation; sparse matrix methods.	None

9 Course Policy

- Requests to the instructor for due date extensions will be considered 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. TAs are not authorized to grant due date extensions.
- Academic dishonesty will be dealt with severely. Among the prohibited activities are:
  - Turning in code or answers you did not write (except that you may use any code in the course example directories on your RPi). Students who in the instructor's judgment have cheated will receive a grade of "0" for that entire assignment. **Turning in code from the Internet or code generated by AI is cheating.**
  - Attempting to misuse any course-related computer system.
  - Tampering with another student's coursework.
  - Making false claims of lost and/or ungraded coursework.
  - **Publicly posting homework problems or your solutions in any way.**

  NOTE: You are encouraged to discuss the homework with other students in the class, but be sure to write your own answers and 100% of the code you turn in!

10 DSP Accommodations

I am committed to providing every student the opportunity to fully participate in this class, and reasonable accommodations will be granted to students with disabilities. I am also committed to ensuring that all students are held to the same standards, and I will not grant requests for *unreasonable* accommodations or exceptions to course policy. If I feel that a particular accommodation is unreasonable or fundamentally alters what you are required to do for the course, I will contest it. All requests for accommodation must be submitted to the DSP office, according to their procedures, well in advance of when the accommodation is needed.

11 Why Bother?

A moment's thought should be all it takes to convince yourself that computers aren't going to become less important any time soon. As far as physics is concerned, as one of my colleagues remarked, "Computers are the new calculus!" When I was in grad school, we learned to solve boundary value problems the old-fashioned way, with pencil and paper, approximating everything with very simple geometries. Just about nobody doing actual research ever does that anymore.

During my lifetime, computers have gone from room-sized machines processing paper cards to systems that can learn the most difficult games from the rules, and in less than 24 hours teach themselves to play well enough to beat the best human masters. It is difficult to imagine what these machines will be doing 30 years from now.

A deep understanding of computers and how to use them will make you a more powerful physicist, and will immensely increase your ability and value to employers no matter what technical field you choose to pursue.