UNIVERSITY OF ALABAMA
Department of Physics and Astronomy

PH126: Honors General Physics with Calculus II

Spring 2009

1 Instructor

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2 Course Description

PH 126 Honors General Physics with Calculus II. Four hours.

Formally: Lecture, discussion, and laboratory. Introductory calculus-based course in classical physics, including electricity, magnetism, and optics. Degree credit can only be awarded for one of the following: PH 102, PH 106, or PH 126.

Informally: Let's face it: if you're looking at the honors course description, you probably already know a little bit about physics. You probably even took some physics already. In PH126, we take off the kid gloves, and get right down to Serious Physics. The topics will be parallel to those in PH106, but significantly more advanced mathematically. Our derivations and formalisms will be more general, our problems more involved (and more realistic!), and our discussions more lively. We will use elementary calculus freely; concurrent registration in a math subject more advanced than Math 126 is not a bad idea.

In PH126, we aim to provide you with a deep understanding of introductory electricity and magnetism, and optics at a considerably higher (and more theoretical) level than PH106. Unlike PH106, in PH126 we will also touch on quantum and atomic phenomena that form the basis for chemical and biological interactions, providing a segue into many of the most recent developments in physics. Compared to PH106, the mathematical sophistication will be much greater - you will have a deeper and more theoretical understanding that will provide a firmer foundation for later courses in physics.

This is the course for physics majors, honors students, and those of you that enjoy a challenge. PH126 is our second honors calculus-based introduction to physics, and is aimed at students who really, really want to know How Things Work. Laboratory experiments will augment lecture- and discussion-based learning, and introduce students to key experimental techniques and analysis. The course will stress a conceptual and mathematically rigorous understanding of everyday phenomena in terms of their basic underlying physical principles. Broadly, the course material can be grouped into the following areas:

3 Course Topics

Broadly, the course material covers the following topics:

- Electric forces and energy
- Current & resistance
- Circuits
- Magnetism
- Electromagnetic induction
- Electromagnetic waves
- Geometric Optics
- Wave optics

4 Prerequisites:

Formally, PH105 or PH125, Math 126 or Math 146, and membership in the university honors program or permission of the department.

Informally: you need to know your calculus, or PH126 will eat you alive . . . the math prerequisite is a good working knowledge of differential and differential calculus, the physics requirement is a good working knowledge of mechanics, and we mean it.

Concurrent registration in a math subject more advanced than Math 126 (e.g., Math 227 or 238) is not a bad idea, though you will be fine without. It is more important that you know your Math 125 and 126 very well.

5 Course Goals and Objectives

General Learning Outcomes for 100- and 200-level courses

1. Recognizing physics concepts that involve developing mathematical models of ordinary phenomena, such as weights and measures, moving objects and forces. [knowledge, evaluation, analysis]
2. Knowing the scientific method and the process of critically evaluating scientific information. [knowledge, comprehension, evaluation]

Anticipated Learning Outcomes for this Course

1. Identifying the known and unknown variables in a physics problem. [comprehension] ?
2. Describing a physical situation with a diagram. [knowledge, analysis]
3. Recognizing the formulae needed to solve a physics problem. [comprehension, knowledge]
4. Formulating the solution of a physics problem. [analysis, synthesis]
5. Analyzing the accuracy of a result. [evaluation]
6. Estimating the order of magnitude of a result. [evaluation]

Assessment of Outcomes for 100- and 200-Level Courses

1. The concept part is covered on our concept inventory tests such as the BEMA and conceptual homework, exam and quiz questions.
2. Assessed by performing laboratory experiments that emphasize the application of the scientific method.

6 Course Format

Physics 126 follows the "Studio Physics" format adopted by the department. This is a format that combines the lecture and laboratory parts of the physics class, doing away with traditionally separated lecture and lab periods. Our classes meet twice a week for two (2) hours, and a third time for a single recitation hour. These meetings take place in a specially designed learning space where students have access to computers, electronic data-collecting apparatus, and three instructors. Instructors have access to video cameras, two LCD projectors, the Internet, and considerable software.

During normal class periods (two hours each) there will be a mix of short lectures and laboratory activities, roughly equally divided. The group activities include short lab experiments using a computer for data acquisition and analysis and other short 'exercises'. The exercises will consist of real-world problems and computer simulations. The one-hour Friday class is a 'recitation' section which will consist of a mixture of new material and problem solving.

It is expected that the students read the appropriate textbook section before each class. This is essential for being able to follow the class and for achieving a good grade. You have to think of the book being not just a support for the class, but as the starting point for your own studying. Because of time limitations, lectures are necessarily brief, and not all material can be covered. Students should use class time to clarify questions regarding the reading material. This can happen through discussions with their peers or the instructor.

An understanding of mathematics, as covered *e.g.* in Math 126, is an essential class pre-requisite.

7 Required and Recommended Items

7.1 Primary text

Griffiths, David J. *Introduction to Electrodynamics.* 3rd ed. Upper Saddle River, NJ: Prentice Hall, 1998. ISBN: 9780138053260. Older additions are acceptable, students are encouraged to find used texts online.

7.2 Reference Texts

These are useful references you can find in the UA libraries. If you are a physics major, you might think about picking them up used, they are worth the money.

Purcell, Edward M. *Electricity and Magnetism.* In Berkeley Physics Course. 2nd ed. Vol. 2. New York, NY: McGraw-Hill, 1984. ISBN: 9780070049086.

Feynman, Richard P., Robert B. Leighton, and Matthew Sands. *The Feynman Lectures on Physics.* 2nd ed. Vol. 2. Reading, MA: Addison-Wesley, 2005. ISBN: 9780805390452.

For some material (e.g., optics and circuits) we will make use of supplemental online notes from PH102, which you can find there:

`http://faculty.mint.ua.edu/~pleclair/ph102/Notes/`

7.3 Calculator

A basic scientific calculator with trigonometric and logarithmic functions is required. Nothing more complicated (such as a graphing calculator) will be of much additional help.

8 Course Web Site

In an attempt to make things easier for everyone, we have been using a "blog" format to make available all course information as rapidly as possible. It will be constantly updated, for example to provide homework hints, laboratory procedures, schedule updates, and various announcements, *etc.* The course blog can be found at:

`http://ph126.blogspot.com/`

There are a lot of reasons for doing this. Here are a few.

- the easier it is for the instructor to post information, the more often it will happen.
- atom/rss feeds so you don't have to constantly look for updates
- you can post comments and give feedback ... and you will get a reply

Bookmark this blog, as it will be your main source of information for PH126 this semester. A few other points about the course web site:

- all course content (quiz/homework solutions, labs, *etc.*) will be posted as links to PDFs
- inappropriate comments will be deleted
- all past posts will be archived and searchable, e.g., for retreiving links to old notes
- since this blog is publicly viewable, no grades or personal information will be posted here or anywhere else. your privacy will be preserved
- since this blog is publicly viewable, think before you post personal information
- anonymous comments will be allowed, so you can ask questions without hesitation

8.1 Other On-line Resources

Further attempting to go paperless, this semester's complete course calendar is available as a Google calendar, links for which can be found in the course blog. You can simply view the calendar (which is also embedded at the bottom of the blog), or subscribe to it if you are a "gmail" user. This will allow you to be notified automatically when you have homework due, for example.

The course calendar will include due dates for homework, the material you are expected to read before class, lab dates, exam dates, *etc.* Clicking on individual events (such as a lecture) will give you more information (such as the chapter covered that day).

In addition to the course blog, this section of physics 126 has a facebook group. It is a closed group (you need to request membership or be approved) and restricted to the Alabama network. Most of the course information will still be posted on the course blog, but facebook seems to provide an easier mechanism for discussion and feedback. The group page can be found here:

`http://www.facebook.com/group.php?gid=105099865470`

or accessed from the course blog. Someting to note: using the 'feed friend' facebook application, you can subscribe to a news feed for the course blog, and thereby get all of your ph126 info via facebook alone. Using this application will put a ph126 news feed right on your facebook home page. Very handy if you'd rather just check one site every day.

9 Grading

Table 1: *Grading Breakdown*

		%	
Component	**Sections**	section	total
In-class work	Labs & Exercises†	15	
	Quizzes†	10	
			25
Outside work	Homework problems†	25	
			25
Hour Exams	Exam I	10	
	Exam II	10	
	Exam III	10	
			30
Final Exam			20

† The lowest single grade will be dropped.

Broadly, the in-class course work will consist of lab experiments, in-class exercises, and frequent quizzes. There will also be three in-class exams as well as a comprehensive final exam during the end-of-term exam period. Outside work will include weekly written homework problems. Each of these components is described in more detail below, their relative weights in determining your overall grade are shown in Table 1, and the grading scale used is detailed in Table 2 on page 9 of this document.

9.1 Exams

There will be three "hour" exams, each covering several thematically consistent chapters, and one comprehensive final exam. The "hour" exams will be administered during regular class periods, and will in reality take approximately 90 minutes, while the final exam will be administered during the usual period at the end of the semester. For all exams, you are allowed *only* the following items:

- Writing implement(s)
- Calculator (no cell phones or PDAs)
- one or two prepared 8.5×11 inch formula sheet(s)[i]

The hour exams will both have slightly different formats, but each one is worth an equal amount (*viz.* 10% of your total grade each). None of the exams will feature multiple-choice questions, though you will usually be given a choice of problems (*e.g.*, solve 4 out of the 8 problems listed). The exam dates will be listed on the course calendar (see above) during the first week of classes. See Sect. 10 for policies regarding missed exams. **Ignorance of these exam dates when booking travel arrangements is not a valid reason for rescheduling.**

9.2 Labs & Exercises

In-class exercises (simulations or calculations) and laboratory procedures will be a major part of each laboratory period. There will be either a laboratory write-up or exercise due after *every single lab period*. Both labs and exercises will be done in groups of 3-4 students. You are free to form your own groups, and even vary them from week to week if you choose, so long as you are productive and share the work load. Should your self-assembled groups be deemed dysfunctional, new groups will be assigned.

The lowest lab/exercise will be dropped at the end of the semester. This policy is meant to allow you the flexibility to miss a limited number of class periods when the situation calls for it. Don't miss too many, make them count. Whenever possible, contact Dr. LeClair in advance about absences – certain circumstances merit unquestioned and fully excused absences (see Sect. 10).

9.3 Quizzes

At the start of each lecture, a short quiz may be given based on the previous lecture's material and the assigned reading. Quizzes will generally consist of solving a single problem similar to those covered in

[i] Whether you get one or two depends on the particular exam.

the last class period, and will be designed to take you $\sim$10 minutes or less. You will be allowed about 15 minutes just in case. The lowest quiz grade will be dropped at the end of the semester.

9.4 Homework

There is homework due essentially every class period. Homework will be posted on the course blog as a linked PDF file (available in hard copy upon request). On average, five to seven problems will be assigned per week, with varying due dates: two problems will be due at the start of the following Tuesday's lecture, two more will be due at the start of the following Thursday's lecture, and the final problems will be due by the end of the day on the following Friday. Late problems will be assessed a per-day penalty of 25%. The lowest homework grade will be dropped at the end of the semester.

The idea is that you will solve the complete homework set spread out over the course of an entire week, rather than at the last minute. Tuesday's problems will be similar to material covered on the previous Friday's recitation, while Thursday's problems will be similar to material covered on the previous Tuesday's lecture, *etc.* The problems will ramp up in difficulty as the week progresses. A problem solving template is provided at the end of this syllabus, you may use the template for your homework solutions but it is not required.

Problem sets may be turned in by hard copy or electronically. Hard copies may be left in Dr. LeClair's mailbox (Gallalee 206) or office (Bevill 228), or turned in at the beginning of class. Any readable format, electronic or physical, is accepted for homework solutions. *You must show your work for every problem to receive credit.* Answers alone – even correct ones – will not receive credit without work shown. You may collaborate on problem sets, and are encouraged to, but each student must turn in their own work.

10 Attendance Policies and Making up Missed Work

No makeup of in-class exercises or laboratory procedures will *generally* be given. If you have a legitimate and acceptable reason for missing a class(*with documentation*), then the missed in-class work will not be counted for or against you. In short, if the absence is properly documented, you get a "bye."

Missed quizzes with an acceptable, documented reason should be made up before the absence if at all possible, either directly after the preceding class, or by appointment. Depending on the reason, a make-up quiz may be scheduled during the following week.

If you have a **legitimate** *reason for missing a major exam*, then you must inform the instructor as soon as possible **before the exam occurs**. If the reason is acceptable, either the exam will be dropped for you, and the final exam will count proportionately more, or you may make up the exam at a slightly earlier or later date. We reserve the right to administer a modified make-up exam slightly differing from the exam the rest of the class has taken. **There is no makeup possible for missing the final exam.**

Acceptable reasons must be documented, if possible in advance, and *may* include but are not limited to: prior athletic commitments, medical issues, off-campus academic commitments, prior commitments to on-campus academic events, band travel, standardized testing, graduate school interviews, and certain personal/family issues. Unacceptable reasons are fairly numerous. Among the least likely to be accepted are oversleeping, leaving early for academic breaks, and fan travel to 'away' athletic events.

As described above, the lowest grades on labs, in-class exercises, and recitation work will be dropped. This will allow a limited number of missed classes (regardless of the reason).

11 Office Hours

Dr. LeClair is generally available on an hour's notice most days, and will arrange time by appointment whenever possible at various locations around campus. Email and phone requests can usually be accommodated within a couple of hours. Meeting times are best arranged at *your* convenience – just call (cell: 857-891-4267) or email (patrick.leclair@gmail.com) to arrange a meeting time, and you will be readily accommodated. Dr. LeClair is generally available for email/blog comment responses until the very early hours of the morning, particularly nights before homework due dates or exams. Comments posted to the course blog or Facebook group (see Sect. 8) will be answered swiftly.

Dr. LeClair' official office hours in addition to specific appointments will be the hour following class each day, 1-2pm in 110 **Gallalee**. In addition, most afternoons from 3-6pm are available, with a quick phone call or email. He may often be found in his laboratory (Bevill 180) when not in his office.

12 Academic Misconduct

Students are expected to follow the Code of Student Conduct, as laid down by The University of Alabama. All acts of dishonesty in any work constitute academic misconduct. In particular each student is expected to do his/her own work on quizzes and exams. Suspected violators of this policy will be referred to the Arts and Sciences Dean's Office. On homework, however, students are encouraged to work together.

13 Disability Accommodations

To request disability accommodations, please contact Disabilities Services (348-4285). After initial arrangements are made with that office, contact Dr. LeClair.

Table 2: *Grading Scale*

Grade			
Letter	Numerical	Min. %[†]	Description
A+	4.33	97%	Superior ability or attainment significantly beyond all minimum expectations
A	4.00	93%	
A-	3.67	90%	
B+	3.33	87%	Good ability or attainment which meets and exceeds many minimum expectations
B	3.00	83%	
B-	2.67	80%	
C+	2.33	77%	Ability or attainment which is acceptable and meets all minimum (required) expectations
C	2.00	73%	
C-	1.67	70%	
D+	1.33	67%	Ability or attainment which does not meet all minimum (required) expectations
D	1.00	63%	
D-	0.67	60%	
F	0.00	0-59%	Attainment of some, but not a number of minimum expectations. Not appropriate for a minimum professional level of performance

[†] Fractional percentages are *always* rounded up, *e.g.*, 69.2% becomes 70%.