PH106: General Physics with Calculus II
Fall 2008

1 Instructors

Lecturer: Dr. Patrick R. LeClair
email: pleclair-at-ua.edu
office: 110 Gallalee / 228 Bevill

Teaching Assistant: Neha Pachauri
email: npachauri-at-bama.ua.edu
office: 215 Gallalee

2 Course Description

PH 106: General Physics with Calculus II. Four hours.

Formally: Lectures 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: What makes the sky blue, or the colors on a rainbow? How do electronics really work? How about the hard disk in your computer, or a Magnetic Resonance Imaging (MRI) machine? Maybe the touch screen on your iPhone®? In PH106, we aim to present the fundamental physics that answers these questions - among many others.

PH 106 continues our calculus-based introduction to physics, and is aimed at students who desire (or require) a detailed working physics background, particularly calculations and problem solving. 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 mathematical* understanding of everyday phenomena and recent technologies in terms of their basic underlying physical principles.

3 Course Topics

Broadly, the course material can be grouped into the following areas:

- Electric forces, energy, and capacitance
- Current and resistance; dc circuits
- Magnetism
- Electromagnetic induction and ac circuits
- Electromagnetic waves & the nature of light
- Reflection and Refraction
- Mirrors and Lenses
- Wave optics

4 Prerequisites:

Formally: MATH 126 and PH 105.

Informally: a good grasp of algebra, geometry, trigonometry, vectors, differential calculus, and integral calculus are crucial. In particular, differential and integral calculus will be used on a daily basis, and familiarity will be assumed. Mathematics is the language that physicists use to describe the world around them - fluency is a requirement. Moreso than PH105, a good working knowledge of different coordinate systems (e.g., polar and cylindrical) and vector manipulations will be absolutely essential.

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. Judiciously discriminating between reliable and less reliable information in decision-making. [analysis]
3. Knowing the scientific method and the process of critically evaluating scientific information. [knowledge, comprehension, evaluation]

Anticipated Learning Outcomes for this Course

Upon completion of this course you should have a basic understanding of electricity, including electric circuits, magnetism and optics. Expected learning outcomes include but are not limited to:

General learning outcomes

1. **Scientific method:** You should be able to recognize and explain the scientific method, and evaluate scientific information.
2. **Effective teamwork:** You should be able to collaborate and perform effectively in team activities.

Course specific learning outcomes

1. **Conceptual understanding:**
   You should be able to **answer** conceptual questions which require a solid understanding of electrical and magnetic forces.

You should be able to **apply** the concepts of electric fields and electric potential to relevant problems.

You should be able to **apply** the concepts of magnetic fields to relevant problems.

2. **Application of basics laws of physics:** You should be able to apply the laws of physics to formulate a solution to a problem.
3. **Analysis of electric circuits:** You should be able to analyze electric circuits and predict their function.
4. **Knowledge of optics:** You should be able to solve problems which require the knowledge of ray optics and optical image formation.

6 Course Format

Physics 106 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 group 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 devoted to problem solving and weekly quizzes.

After completing this course, the student should have both a conceptual and a quantitative understanding of the description of the topics listed above. This will include the ability to set up and solve simple problems relating to electrical and magnetic forces, fields, circuits, lenses and mirrors, interference, and related concepts. The student should be able to analyze problems both qualitatively and quantitatively

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 thus an essential class pre-requisite.

7 Required and Recommended Items

7.1 Primary text

Serway and Jewett, Physics for Scientists and Engineers Vol. II, 7th edition. Older additions are acceptable; the differences are minimal. The combined two-volume textbook (which you may have already purchased for ph105) is also acceptable, but you need only volume II for this course.

7.2 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://ph106.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 PH106 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 106 now 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.new.facebook.com/group.php?gid=23452510908`

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 ph106 info via facebook alone. Using this application will put a ph106 news feed right on your facebook home page. Very handy if you'd rather just check one site every day.

Finally, the laboratory hardware and software used for many of the experiments is a system currently under development by Dr. LeClair. An overview of the system, including a 'wiki' software and hardware manual, can be found here:

`http://code.google.com/p/bamalab/`

On this site, or included in the course notes packet, you will find a paper we have recently written about the laboratory hardware and software, which can give you an overall background about the system's capabilities and features. Some of the information is a bit technical, but the overall picture should be clear.

9 Grading

Broadly, the in-class course work will consist of lab experiments, in-class exercises, quizzes, and an in-class personal response system. There will also be two 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, and a term paper. Each of these components is described in more detail below, their relative weights in determining your overall grade are shown in Table **??**, and the grading scale used is detailed in Table **??** at the end of this document.

Table 1: *Grading Breakdown*

		%	
Component	**Sections**	section	total
In-class work	Labs & Exercises[†]	12.5	
	Quizzes[‡]	12.5	
			25
Outside work	Homework problems[‡]	20	
			20
Hour Exams	Exam I	15	
	Exam II	15	
			30
Final Exam			25

[†] The lowest two grades will be dropped.
[‡] The lowest single grade will be dropped.

9.1 Exams

There will be two "hour" exams, each covering several thematically consistent chapters, and one comprehensive final exam. The "hour" exams will be administered during laboratory 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.* 15% of your total grade each). Hour exam I will be entirely multiple choice, while hour exam II will consist only of problems to solve. The final exam will be half multiple choice and half problems. In exam II and the final, which have non-multiple-choice problems to solve, 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. **??** for policies regarding missed exams. **Ignorance of these exam dates when booking travel arrangements is not a valid reason for rescheduling.**

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

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*, and they will count as 15% of the course grade. 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 two lowest labs/exercises 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. **??**). No homework or quiz grades will be dropped.

9.3 Quizzes

During each Friday lecture, short quizzes will be given based on lectures given during the week and/or the most recently submitted homework assignment. Quizzes will generally be 5 questions long, in multiple choice format, and will be designed to take you $\sim$15 minutes or less. You will be allowed about 25 minutes just in case.

Additional short quizzes will be given at random over the course of the semester. These quizzes will often unannounced, frequently spontaneous, and always short. At the end of the semester, roughly half of your quiz grade will be due to these informal quizzes, and the other half due to the "formal" Friday quizzes.

9.4 Homework

Homework problems are assigned each week on Friday, and due the following Friday at 5pm. These weekly problem sets will be posted on the course blog as a linked PDF file, and available in hard copy upon request. Prior problem solutions will also be posted (typically) each Monday evening. Both problem sets and solutions will be stored here:

`http://faculty.mint.ua.edu/~pleclair/ph106/Homework/`

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 to the graduate assistant. 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. However, 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 or email 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. **??**) will be answered swiftly.

Dr. LeClair' official office hours in addition to specific appointments will be the hour preceeding class each day, 12-1pm in **110 Gallalee**. In addition, most afternoons from 3-5pm are available, with a quick phone call or email. He may often be found in his laboratory (Bevill 180) when not in his office. His contact info (email/office phone/cell) will be made available during the first class periods.

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%.