

# PH 126 Section 001: Honors Gen Ph W/Calculus

Fall 2011

4 Credit Hours

Primary Instructor: Dr. Patrick Leclair

Core Designation: Natural Science, University Honors

Syllabus subject to change.

## Prerequisites

From the Student Records System

Both

- - MATH 126 (undergrad)
  - Or
  - MATH 146 (undergrad)

And

- - PH 105 (undergrad)
  - Or
  - PH 125 (undergrad)

Additionally, students must be members of the university honors program, majoring in physics, or request permission of the department.

## Course Description

A calculus-based introductory course including electricity, magnetism, and optics. Lectures and laboratory. Students will be introduced to the essential conceptual and mathematical structure of electricity, magnetism, and optics. Inquiry-based 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.

## Student Learning Outcomes

### 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]

## Outline of Topics

- Electric forces and fields
- Electrical 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

Tentative schedule:

August

24W Introduction & math review / Arduino introduction

26F Electric forces & fields

29M Electric forces & fields / basic Arduino I/O

31W Gauss' law / sensors and feedback / LAST DAY TO DROP WITHOUT W

Sept

2F electric potential

5M LABOR DAY

7W electric potential / sensors and feedback

9F EXAM 1

12M potential, conductors, current / resistors, LEDs, photoresistors

14W current, resistance, dc circuits / dc circuit construction

16F dc circuits

19M capacitance & dielectrics / transistors

21W capacitance & dielectrics / transistors

23F magnetic fields

26M magnetic fields / transistor circuits

28W induction / integrators, differentiators, and filters

30F induction

Oct

3M ac circuits & impedance / oscillators

5W maxwell's equations & EM waves / op amps

7F EXAM 2

10M EM waves / amplifiers and modulation

12W Networks, circuit analysis / op amp circuits / MIDTERM GRADES DUE

14F Drude model

17M Energy & information / timers

19W relativity / timers

21F relativity

24M moving charges & radiation / mid-semester circuit project

26W radiation / mid-semester circuit project

28F NO CLASS

31M scattering / mid-semester circuit project

Nov

2W propagation of light / mid-semester circuit project / LAST DAY TO DROP WITH W

4F geometric optics

7M mirrors / final project selection

9W lenses / final project (description due)

11F optical instruments & systems

14M polarization / final project (parts list due)

16W interference & diffraction / final project (progress memo due)

18F interference & diffraction

21M resonators / final project

23W NO CLASS

25F NO CLASS

28M waveguides / final project

30W more on potentials / final project (progress report due)

Dec

2F EXAM 3 / LAST DAY FOR TESTS/ETC

5M field energy & momentum / final project

7W magnetic materials / final project demonstration

9F TBD / END

12-16 Final examinations (take-home final)

## Exams and Assignments

There will be three “hour” exams, each covering several thematically consistent chapters, and one comprehensive final exam. The “hour” exams will be administered during lecture periods, while the final exam will be administered during the usual period at the end of the session. 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)

The hour exams may both have slightly different formats, but each one is worth an equal amount. On both hour exams and the final, you will usually be given a choice of problems (e.g., solve 4 out of the 8 problems listed).

### Labs & Exercises

In-class exercises (simulations or calculations) and laboratory procedures will be a major part of each class 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 2-4 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. Occasionally, there will be a simple take-home experiment assigned.

The single 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.

### Quizzes

Occasionally, short quizzes may be given based on material covered 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 ~ 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. The lowest single quiz grade will be dropped.

### Homework

Homework problems typically are due every second lecture period, and must be turned in by the end of the day (though they can be turned in earlier). Problem sets may be turned in by hard copy or electronically. Hard copies may be left in Dr. LeClair's mailbox (Gallalee 206) or offices (Gallalee 323 and Bevill 2050). Electronic copies may be submitted by email to [leclair.homework@gmail.com](mailto:leclair.homework@gmail.com).

These problem sets will be posted on the course blog as a linked PDF file, and available in hard copy upon request. Both new problem sets and solutions to past problem sets will be stored here:

<http://faculty.mint.ua.edu/~pleclair/ph126/Homework/>

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. The lowest single homework grade will be dropped.

## Grading Policy

Broadly, the in-class course work will consist of lab experiments, in-class exercises, and quizzes. 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 occasional take-home experiments. Each of these components is described in more detail above, their relative weights in determining your overall grade are shown below.

Labs & Exercises 15%

Homework and quizzes 25%

Exam I 15%

Exam II 15%

Exam III 15%

Final Exam 15%

### Grading scale

A+ 4.33  $\geq$ 97.5

A 4.00 92.5

A- 3.67 90

B+ 3.33 87.5

B 3.00 82.5

B- 2.67 80

C+ 2.33 77.5

C 2.00 72.5

C- 1.67 70

D+ 1.33 67.5

D 1.00 62.5

D- 0.67 60

F 0.000 <60

## Policy on Missed Exams & Coursework

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).

## Attendance Policy

None.

## Required Texts

UA Supply Store Textbook Information

- **HALLIDAY (RENTAL) / (RENTAL) FUNDAMENTALS OF PHYSICS VOL 2**  
(RENTAL)
- **HALLIDAY / FUNDAMENTALS OF PHYSICS VOL 2**  
(Required)

## Other Course Materials

See the course web site at <http://ph126.blogspot.com/> for notes, detailed schedules, etc.

## Extra Credit Opportunities

Probably not.

## Policy on Academic Misconduct

All students in attendance at the University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University expects from its students a higher standard of conduct than the minimum required to avoid discipline. Academic misconduct includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student.

[The Academic Misconduct Disciplinary Policy](#) will be followed in the event of academic misconduct.

## Disability Statement

If you are registered with the Office of Disability Services, please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary. If you have a disability, but have not contacted the Office of Disability Services, please call 348-4285 or visit 133-B Martha Parham Hall East to register for services. Students who may need course adaptations because of a disability are welcome to make an appointment to see me during office hours. Students with disabilities must be registered with the Office of Disability Services, 133-B Martha Parham Hall East, before receiving academic adjustments.

## Severe Weather Protocol

In the case of a tornado warning (tornado has been sighted or detected by radar; sirens activated), all university activities are automatically suspended, including all classes and laboratories. If you are in a building, please move immediately to the lowest

level and toward the center of the building away from windows (interior classrooms, offices, or corridors) and remain there until the tornado warning has expired. Classes in session when the tornado warning is issued can resume immediately after the warning has expired at the discretion of the instructor. Classes that have not yet begun will resume 30 minutes after the tornado warning has expired provided at least half of the class period remains.

UA is a residential campus with many students living on or near campus. In general classes will remain in session until the National Weather Service issues safety warnings for the city of Tuscaloosa. Clearly, some students and faculty commute from adjacent counties. These counties may experience weather related problems not encountered in Tuscaloosa. Individuals should follow the advice of the National Weather Service for that area taking the necessary precautions to ensure personal safety. Whenever the National Weather Service and the Emergency Management Agency issue a warning, people in the path of the storm (tornado or severe thunderstorm) should take immediate life saving actions.

**When West Alabama is under a severe weather advisory, conditions can change rapidly. It is imperative to get to where you can receive information from the [National Weather Service](#) and to follow the instructions provided. Personal safety should dictate the actions that faculty, staff and students take. The Office of Public Relations will disseminate the latest information regarding conditions on campus in the following ways:**

- Weather advisory posted on the UA homepage
- Weather advisory sent out through Connect-ED--faculty, staff and students ([sign up at myBama](#))
- Weather advisory broadcast over WVUA at 90.7 FM
- Weather advisory broadcast over Alabama Public Radio (WUAL) at 91.5 FM
- Weather advisory broadcast over WVUA 7. WVUA 7 Storm Watch provides a free service you can subscribe to that allows you to receive weather warnings for Tuscaloosa via e-mail, pager or cell phone. Check <http://www.wvua7.com/stormwatch.html> for details.