Syllabus for PHYS 115: Inquiry into Physics

Section 0201, Spring 2007

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http://www.physics.umd.edu/courses/Phys115/giridhar/spring08/phys115home.html

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Who, Where, When

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Physics 3316, MTuW 2.00 PM- 3.50 PM

About this Course:

Physics 115 is a course designed especially for students majoring in elementary education and early childhood. It was designed by a former president of the American Association of Physics

Teachers, Dr. John Layman. Most physics courses are designed to introduce you to a wide variety of facts about our physical world, facts that many scientists have accumulated over hundreds of years. For example, in a typical physics course, you learn how to calculate the path a rocket will take after it is launched, why there are rainbows, how nuclear power plants work, etc. However, this course is very different. Instead of teaching you a bunch of facts, we will work with you, and help you learn how to study physical systems by yourself, and as part of a learning group. You will in effect be a scientist yourself. You will make observations, try to understand them, and try to convince your colleagues in your scientific community that your thoughts make sense! This kind of course is called "inquiry-based" learning. Memorization will not be sufficient. In all instances you will be asked to support the answers you have obtained with your own personal observations and conceptual explanations, augmented by information from other resources. We will utilize qualitative understanding in support of our quantitative work.

The laboratory activities are the key to the course. They have a large weight in your final grade, and the exams will also emphasis this work. Most of the concepts that we deal with will be encountered first in the guise of laboratory activities. Along with your lab group you will observe physical systems, predict their behavior, test your predictions, and draw your own conclusions based on your laboratory experiences. You and your lab partners will be the world's most knowledgeable persons in this enterprise and the negotiators of our final understanding of each concept. Your teachers are resources, but they cannot do the understanding for you, nor simply tell you of theirs.

Credits, Prerequisites, etc

- For Elementary Education and Early Childhood Majors only
- 4 credit hours
- Credit will be granted for only one of Phys 115 or Phys 117
- Prerequisite: none

Books and other required materials

This class has no text book. Instead, you will keep a laboratory notebook It must be a three ring binder. You will also need to bring a calculator to class and to exams

In the notebook, you should put the lab manual, your graded homeworks that have been returned to you, and lots of blank paper so you can record your observations, the observations of your peers, your theories, the theories of your peers, the evidence for each theory, and against each theory. **It is important that you keep a neat, careful notebook, because you have no textbook.** I strongly suggest that every day after class you get together with a few of your classmates, and go over your notebook, make it neat, and make a list of questions of things that still confuse you. **You will receive a grade on the quality of your notebook** (details are given below), and more importantly, **you will be allowed to refer to these materials during the exams**.

If you would like to own a general reference for your own use in your future teaching career, or if you would like a resource which presents the concepts we will learn in class from a different point of view, we suggest*: Hewitt, Conceptual Physics*, published by Harper Collins

Lab Groups

Lab Groups will consist of three students, and should become a stable group during the third week. This modest learning community will share much of the responsibility for the personal understanding of all of its members.

Attendance Policy

Because your presence in the laboratory is essential to both your learning and the progress of your lab group, **attendance will be taken**. **You are allowed two unexcused absences**. You must provide documentation for any excused absences (a note from the health center, etc). 2 points will be deduced from your final grade for every unexcused absence beyond this. Please see http://www.testudo.umd.edu/soc/atedasse.html for the list of valid reasons for an excused absence.

If you are late more than 15 minutes it will be counted as an absence. However, you will still be welcome to attend and profit from your work with the group. When you enter the class, you must check in with the instructor, and see that the instructor records your presence. It is your responsibility to make sure that your presence is properly recorded.

HELP ME!

Your instructors have office hours by appointment, and are happy to help you outside of class. In addition, they will be available before and after class. Don't be shy! We really are happy to work with you!

Graded work

You will be graded on homework assignments, your laboratory notebook, and your participation in class. Each one of these items is discussed in more detail below.

Notebooks

Your notebooks will be collected 2 times during the semester without warning. The grading scheme for each time is as follows:

If you have	You get these points
3 ring binder containing lab book, graded homeworks, and extra blank paper	3
At least partially filled in	3
At least minimal information (not carefully labeled, hard to figure out what it means, random numbers written down without labels, etc) in every part	1
All parts filled in, with at least several parts containing careful, detailed information	1
Most parts filled in with careful, detailed information	0.5
Most parts filled in with careful, detailed information, plus evidence that the person thought about it after class, and had ideas of their own that they recorded, and did not just write down what was said in class.	1.5
Sum:	**10.0**

Homework Assignments

You will have two basic types of assignments, essay questions based on the laboratory work you do in class and problem sets. Each Monday, a homework assignment will be posted on the web page for this class given at the beginning**.** Each homework will contain both essay questions and problems. The homework is due the following Monday at the start of class. If you finish your laboratory work early, you may work on your homework in class, and you can talk to your instructors in class about the homework you are working on.

You may submit late homework. However, I will deduct 0.2 x the total point value of the assignment for each day it is late. Thus, after 5 days, the grade will be zero. However, remember that the average of a 100% and a 50% is 75%, while the average of a 100% and a 0% is 50%, so turning in a homework, even if it's 3 or 4 days late, is much better than not turning it in!

Essays

Each week you will be assigned essay questions based on your laboratory activities. Your essays should be no longer than one page each, excluding graphs and figures. So, you will need to choose your words carefully, in order to fit your response in this space and still answer the question completely. Each essay must be on a separate piece of paper, so they can easily be distributed to different graders. Your essays should be typed. Here are some notes on the kind of things that make a good essay.

Observation

We will be able to demonstrate with laboratory activities most of the concepts or ideas that we will be dealing with in this introductory physical science course. The first skill you will need to develop is that of making personal predictions and describing in your own words what you personally observe as activities being carried out. This will sometimes mean utilizing diagrams

in support of your words, and using words that are already a natural part of your vocabulary. As our work progresses, you will begin making the transition to words that arise from within the science community, a community within which you are now a full participant.

Scholarly Response

On examinations and in your written work, the first stage of a scholarly response will be your personal skill in describing in your own words your predictions or conjectures, what you have observed, followed by words and explanations that may have been provided by you, your labmates, the professor, the TA, the text or lab guide.

Evidence

The best evidence you can offer is the statement "**I saw it**", not "the book said so," or "Dr. So-and-So said." This ability becomes your personal responsibility, and our task is to optimize your chance to do this skillfully. One caveat, however, is the statement that may become more clear as the semester progresses, "If I hadn't believed it, I wouldn't have seen it."

Explanations

Explanations for things observed, offered by you, your labmates, your TA, the teacher, the text, and from other sources must always be greeted with some skepticism. Our observations on the other hand are more reliable and can always be verified by repeating the observation. We must, however, recognize that although we may all be "observing the same event", we may not all "see" the same thing. When explanations for what we observe involve second hand information or inferences from the observations, however correct they may turn out to be, we will occasionally use the term "rumor has it," to indicate that we may not yet have full understanding of a concept.

Problem solving

In most physics classes, homeworks consist of sets of word problems. We will do some word problems each week as well. You will find this a useful way to help see if you really understand a concept.

Class Participation

You will be graded on your class participation. The grading scheme is as follows:

Never participates voluntarily	0
Attempts to answer when asked a question	0.5
Occasionally raises hand	0.7
Raises hand at least once a week	0.85
Raises hand daily	1.0

Exams (what to expect)

There will be two two-hour examinations and one final exam. All exams are cumulative. Each will have a written portion as well as a laboratory activity component. You will do the laboratory portion with your lab group.

Exams will be conceptual in nature, comprised largely of essay questions that will require you to draw from your personal laboratory experiences as you articulate and support your understanding

of physical concepts. When you are asked to solve a quantitative problem you will also be asked to provide a conceptual explanation. Each examination will contain laboratory experience to be completed with your own lab group.

You may use your notebook during the exams.

Recovering points lost on exams

We want all of your to graduate from this class with a good knowledge of physics. So, if you want, you will be allowed to recover points that you lost on each of the first two exams (not on the final). Within 1 week after the exam date, you must contact me to make an appointment to do the retest. The retest will be closed-book and oral. Your final grade on that question = original grade + 2/3 x (new grade-old grade). You can not lose points by doing the makeup. You can only gain points.

How to Calculate your Grade:

Your final grade will be determined as a weighted average of your exam grades, your assignment grades, and your journal grades

total number of points you receive/ total number of possible points for	Weight
Exam 1	0.20
Exam 2	0.20
Final Exam	0.20
Homework Essays	0.17
Homework Problems	0.08
Class Participation	0.05
Notebook	0.10
	1.0
	Subtract 2 points for each unexcused absence beyond the 2 allowed.

The final grade will be set at the end of the semester after all work is completed.

Schedule of activities

Our schedule has to be flexible. Our goal is not to learn a certain number of facts by a certain date. It's to learn a creative process. And, creativity can not always be forced to march to a predetermined beat! We will alter the schedule to make sure the class can move at a pace that we allows this particular class to be creative. You can, however, find a tentative schedule at our web site, http://www2.physics.umd.edu/~mfuhrer/course/spr06/. The dates for the exams, however, are fixed and will not change (and can be found at the same web site).

Cheating

What does it mean to be a scientist? To me, the characteristic that most defines a scientist is the willingness to be truthful. It is tempting, when one does an experiment, to try to force the outcome to be what you "know" it should be. The real scientist is a person who can resist this temptation. To instead look at the data, and see what it is telling you, instead of trying to force to agree with your friend, a textbook, your instructor. I expect you, in this class, to respect your data, and never "cheat" by altering it in any way to agree with results you think you should get.

The integrity of your degree is important to me. Therefore, I strongly support the Code of Academic Integrity of the University of Maryland. What does this mean in a collaborative environment like the one we have in this class?

We are all members of the PHYS 115 learning community so it is quite appropriate to seek help as you pursue your various assignments, and you will be most successful if you work with other students both in and out of the laboratory. This does not, however, mean that identical reports are in order. You will be expected to respond in your own special style, even when the conclusions were reached through group activities.

Course Rationale

Students enrolled in a course should have access to the rationale behind the course and have an indication that the teaching/learning procedures employed arise from best practice as described or defined in national reports. The remainder of this section is made up of quotations from this national document.

SHAPING THE FUTURE
New Expectations for Undergraduate Education in Science,
Mathematics, Engineering, and Technology
A Report on its Review of Undergraduate Education

by

the Advisory Committee to the National Science Foundation
Directorate for Education and Human Resources

Too many students leave Science, Mathematics, Education and Technology (SME&T) courses because they find the dull and unwelcoming. Too many new teachers enter school systems under-prepared, without really understanding what science and mathematics are, and lacking the excitement of discovery and the confidence and ability to help children engage SME&T knowledge. Too may graduates go out into the workforce ill-prepared to solve real problems in a cooperative way, lacking the skills and motivation to continue learning.

We recommend that:

SME&T faculty: Believe and affirm that every student can learn, and model good practices that increase learning; start with the student's experience, but have high expectations within a supportive climate; and build inquiry, a sense of wonder and the excitement of discovery, plus communication and teamwork, critical thinking, and life-long learning skills into learning experiences.

Inquiry – although there is disagreement about the meaning of the term "science literacy" and doubt about whether agreement is possible on a list of facts everyone should know, there is no

disagreement that every student should be presented an opportunity to understand what science is, and is not, and to be involved in some way in scientific inquiry, not just a “hands-on” experience.

VII. SME&T faculty

A. Believe and affirm that every student can learn; recognize that different students may learn in different ways and with differing levels of ability; and create an environment in each class that both challenges and supports.

B. Be familiar with and use the results of professional scholarship on learning and teaching.

C. Build into every course inquiry, the processes of science (or mathematics or engineering), a knowledge of what SME&T practitioners do, and the excitement of cutting edge research.

D. Devise and use pedagogy that develops skills for communication, teamwork, critical thinking, and lifelong learning in each student.

E. Make methods of assessing student performance consistent with the goals and content of the course.

F. Start with the student’s experience; understand that the student may come with significantly incorrect notions; and relate the subject matter to things the student already knows.

G. Build bridges to other departments, seeking ways to reinforce and integrate learning, rather than maintaining artificial barriers.

H. Develop partnerships and collaborations with colleagues in education, in the K-12 sector, and in the business world, to improve the preparation of teachers and principals.

I. Model good practices that increase student learning.

J. Take seriously academic advising that helps students have as much flexibility as possible and is linked to career development services of the institution.