

## General Information

# PHYS 115 : Inquiry into Physics

## Fall 2012

### Instructor

**Dr. Suresh Tonwar**

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### TA

**Ms. Sakina Ali** (E-mail: sakina72@umd.edu)

### Course Pre-Requisite :

No prerequisites. Enrollment is limited to Elementary Education and Early Childhood majors.

### Laboratory Schedule :

Section 0201 ; Mon, Tue and Wed ; 10:00 – 11:50 am ; Room PHYS 3316

### Course Textbook : None

**Course Philosophy :** Scientists learn about the physical world around us through observation and experimentation. They draw conclusions from data and continually refine their ideas. They design new experiments to address new questions as they arise. They present their observations and results at scientific meetings and publish their results in scientific journals and receive criticism and confirmation.

In this course, you will not be memorizing facts listed in a textbook. Instead, you will act as a scientist and learn physics as a researcher would. You will discover facts for yourself! You will conduct experiments and learn how to describe your observations through words, equations and graphs. Your fellow students may draw different conclusions from the same experiment. You will learn how to present your results and defend your observations and interpretation. Sometimes you will decide that your fellow students were right after all, or perhaps you can think of a way to test which ideas are right and which need further refinement.

The inquiry method of learning is particularly relevant for elementary and early childhood teachers, because scientists make discoveries in much the way children learn – by observing the world around them and correlating different observations!

There is no textbook for the course. You are expected to keep a notebook and take a lot of notes. This will act as your textbook. Since this is a course in "inquiry" as well as "physics", make sure you record all of your ideas, even those that you eventually discard, as well as your data. You should be able to reconstruct the evolution of your thinking. You will be asked on homework and exams not only for your answers, but how you arrived at your answer.

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**Grades :** Your grade will be based on:

- Lab Reports: 20%
- Homework : 20%
- Exam 1 : 20% (Tue, Oct 2, 2012)
- Exam 2 : 20% (Tue, Nov 6, 2012)
- Exam 3 : 20% (Tue, Dec 11, 2012)

**Homework :** There will be usually one homework assignment each week. The new assignment will be given at the end of the class each Wednesday and will be due the following Tuesday at the beginning of the class. 50% of the total point value of the homework will be lost if submitted on the following Wednesday and 100% if submitted thereafter. The assignment will consist of essay questions based on the laboratory work done in the class and some problems that may require calculations. The answers to essay questions must be typed but the answers to the problems may be hand-written.

**Lab Notebook :** You will maintain a 3-ring binder type lab notebook containing the following items:

- (1) Syllabus and semester schedule
- (2) Experiment guideline sheets given to you at the beginning of each class
- (3) Lab reports prepared by you during each class, listing your main activity, answers to various questions, results of your observations and your un-answered questions, if any. Each lab report will be given for grading at the end of the class and received back the following week.
- (4) Blank paper for recording your observations, the observations of your peers, your ideas and evidence for and against them, and any relevant data analyses such as graphs. Put the date on each sheet. All sheets related to an experiment should be grouped together.
- (5) Graded homework assignments
- (6) Graded exams
- (7) General notes

Your lab notebook will be checked occasionally.

**Class Participation :** You are expected to participate actively in class discussions, often leading the discussion voluntarily and also when called upon to do so individually.

**Exams :** Each exam will have a laboratory activity part with your lab group and an individual part that includes problems and essays similar to the homework. Exams will require you to draw from your personal laboratory experiences as you explain 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 as well. **You will have access to your Lab Notebook during the exams.**

**Attendance :** Due to the nature of this class, attendance and participation are absolutely mandatory. For each unexcused absence and missed class, you will lose the marks for the lab report for the missed class. If you are more than 10 minutes late for class, your lab report for the day will have only half the value, however, you will still be welcome to join the class and participate in the activity and discussion.

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**Cell Phones :** Due to the nature of this class, cell phones present a huge distraction. Cell Phones must be turned off before entering the class, and phone conversations, as well as texting, are strictly forbidden during class. If you are observed to be texting or speaking on a cell phone in the class, you will be marked absent for the day.

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### **Your role in PHYS 115 :**

*(in other words, how to get a good grade)*

During each class, you will be given at least one lab activity to complete.

- ✓ First, discuss the lab with your lab partner. Can you form a hypothesis regarding what the outcome will be? Why do you expect this outcome? Feel free to discuss your ideas with others and don't worry if your ideas are wrong. That's why we do experiments!
- ✓ Complete the lab activity with your partner. If your partner is having trouble, stop and try to explain what you know to your partner. You will find that assuming the role of the teacher will solidify your own understanding.
- ✓ IF YOU ARE LOST, SPEAK UP!! Ask your lab partner or start a class discussion. There is no textbook to fall back on, so don't count on cramming the night before the exam. Make sure you understand the lab before the class moves on!
- ✓ Write everything in your lab manual. Write your ideas, record all of the data, what worked, and even what didn't. Draw diagrams of your lab set up. Write down your interpretation of the results. Take notes on any discussions you have with others.

- ✓ After you have completed the lab, you might be asked to present your results to the class or lead a discussion. Do your results agree with everyone else's? In talking about your results, you might decide your original interpretation is inconsistent, or you may realize you made an error. That's okay. It's all part of the learning process.
  - ✓ If you "finish" your lab before the other groups, you may think of something else to try or a new avenue of investigation to pursue.
  - ✓ Turn your homework in on time. In grading, we shall be paying particular attention to how much effort you put into the assignment. Please give us answers that are well thought out.
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**Role of your Professor and Teaching Assistant :** This is a class on how to conduct scientific investigations. We are not going to lecture to you! Our job is to moderate discussions, help you develop your own ideas, and point you in the right direction when you get stuck. We might answer your question with a question. One day when you are teaching school, there will not be a professional scientist around to answer your questions. You need to learn how to draw reliable conclusions on your own. You will also find that you learn more effectively from your own experience than you would if you were just asked to read a book and memorize a list of facts.

**Academic Honesty :** The Student Honor Council respectfully requests that faculty members place the following passage in their course syllabi in order to inform students of the consequences of academic dishonesty: "The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism." For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>. Academic Integrity in a collaborative environment like the one we have in this class has a special meaning. We are all members of the Physics 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 and freely discuss with your instructor and TA. However, this does not mean that identical reports or homework answers are acceptable. You are expected to respond in your own special individualistic style, even when the conclusions were reached through group activities. It is sometimes tempting, when doing an experiment, to try to force the outcome to be what you "know and expect" it should be. The real scientist is a person who can resist this temptation. In this class, respect your data and never "cheat" by altering it in any way to agree with results you think you should get.

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## Physics 115 Fall 2012 – Schedule of Experiments

We have selected a total of 40 experiments from 4 major areas of physical phenomena, namely, electricity and magnetism, heat and energy, motion and force and light and optical phenomena, which we experience in our daily life.

### Electricity & Magnetism

Exp # 01	Wed	Aug 29	E01	Batteries and bulbs
Exp # 02`	Tue	Sep 04	E02	Good and bad conductors
Exp # 03	Wed	Sep 05	E03	Batteries in series
Exp # 04	Mon	Sep 10	E04	Size and direction of current
Exp # 05	Tue	Sep 11	E05	Bulbs in series
Exp # 06	Wed	Sep 12	E06	Parallel circuits
Exp # 07	Mon	Sep 17	E07	Voltmeters, ammeters and power supplies
Exp # 08	Tue	Sep 18	E08	Introduction to linear relationships
Exp # 09	Wed	Sep 19	E09	Ohm's law, resistors and power
Exp # 10	Mon	Sep 24	E10	Resistors in series and parallel
Exp # 11	Tue	Sep 25	E11	Practical electricity
Exp # 12	Wed	Sep 26	E12	Magnets
Exp # 13	Mon	Oct 01	E13	– Currents and magnetism

**Tue Oct 02 Exam 1**

### Heat & Energy

Exp # 14	Wed	Oct 03	H01	Heat and temperature
Exp # 15	Mon	Oct 08	H02	Heat transfer and thermal equilibrium
Exp # 16	Tue	Oct 09	H03	Mixing water at different temperatures
Exp # 17	Wed	Oct 10	H04	Mixing unlike materials
Exp # 18	Mon	Oct 15	H05	Specific heats of aluminum and copper
Exp # 19	Tue	Oct 16	H06	Ice, water and steam
Exp # 20	Wed	Oct 17	H07	Mixing ice and water – latent heat of fusion
Exp # 21	Mon	Oct 22	H08	Condensing steam latent heat of vaporization
Exp # 22	Tue	Oct 23	H09	Temperature of liquid nitrogen
Exp # 23	Wed	Oct 24	H10	– Rate of cooling and conservation of energy

### Motion & Force

Exp # 24	Mon	Oct 29	M01	- Introduction to motion detector
Exp # 25	Tue	Oct 30	M02	- Predicting what a graph will look like
Exp # 26	Wed	Oct 31	M03	- Reading a graph and making an equation for it
Exp # 27	Mon	Nov 05	M04	- Instantaneous velocity and acceleration

**Tue Nov 06 Exam 2**

Exp # 28	Wed	Nov 07	M05 - Motion with a constant force
Exp # 29	Mon	Nov 12	M06 - Equation of distance versus time (constant force)
Exp # 30	Tue	Nov 13	M07 - Relation between mass, velocity and acceleration
Exp # 31	Wed	Nov 14	M08 - Force due to gravity and pendulum
Exp # 32	Mon	Nov 19	M09 - Motion of a ball thrown up vertically
Exp # 33	Tue	Nov 20	M10 - Motion of a ball thrown in an arbitrary direction
	<b>Wed</b>	<b>Nov 21</b>	<b>Review and discussion</b>

### **Light & Optical Phenomena**

Exp # 34	Mon	Nov 26	L01 - Light propagation and geometrical optics
Exp # 35	Tue	Nov 27	L02 - View through a pinhole camera (magnification)
Exp # 36	Wed	Nov 28	L03 - Reflection and images
Exp # 37	Mon	Dec 03	L04 - Refraction, ray diagrams and Snell's law
Exp # 38	Tue	Dec 04	L05 - Introduction to lenses
Exp # 39	Wed	Dec 05	L06 - Lenses and ray diagrams
Exp # 40	Mon	Dec 10	L07 - Eyes as an optical instrument (corrective lenses)

**Tue Dec 11      Exam 3**

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## PHYS 115 Course Rationale

Students enrolled in a course should have access to the rationale behind the course and have an indication that the teaching and 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 them 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 many graduates go out into the workforce ill-prepared to solve real problems in a cooperative way, lacking the skills and motivation to continue learning.

**Recommendations to 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. 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.

**Importance of 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. Inquiry, the processes of science (or mathematics or engineering), a knowledge of what SME&T practitioners do, and the excitement of cutting edge research should be built into every course.

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