General Information

PHYS 115 : Inquiry into Physics

Fall 2011

Instructor

Dr. Suresh Tonwar

Phys. Rm. 4333; Phone : 301-405-6068; E-mail: tonwar@umd.edu

TA's

Ms. Allison Bradford; Mon and Tue (E-mail: allie180@comcast.net) and

Ms. Kristy Weber; Wed (E-mail: kjweber@terpmail.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.

Grades : Your grade will be based on:

Lab Reports: 30%
Exam 1 : 10% (Wed , Oct 5, 2011)
Exam 2 : 10% (Wed, Nov 9, 2011)
Final exam : 20% (Tue, Dec 13, 2011)
Homework : 20%, and
Lab Notebook : 10%

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 and will be collected on the day of the final exam for grading.

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 loose the marks for the lab report for the missed class. If you are more than 15 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.

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.

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.

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.

Physics 115 Fall 2011 - List of Experiments

We have a total of 52 experiments available 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. However, we have only 36 lab days available during the Fall 2011 semester, excluding the review and exam days. So we shall be choosing a number of experiments from each of the 4 groups, as we go along, based on the progress in your understanding and interest.

Electricity & Magnetism

E01 Batteries and bulbs
E02 What materials are conductors?
E03 Batteries in series
E04 Size and direction of current
E05 Bulbs in series
E06 Parallel circuits
E07 More on parallel circuits
E08 Voltmeters, ammeters, and power supplies
E09 Introduction to linear relationships
E10 Ohm's Law
E11 More about resistance and resistors
E12 Equivalent resistance and power
E13 Practical electricity
E14 - Magnets
E15 - Currents and magnetism

Heat & Energy

H01 Heat and temperature, what do they mean?
H02 Thermal equilibrium
H03 Mixing water at different temperatures
H04 Heat transfer, what does it mean?
H05 Mixing unlike materials
H06 Specific heat of aluminum
H07 Introduction to ice
H08 Mixing ice and water
H09 Melting ice latent heat of fusion
H10 Condensing Steam latent heat of vaporization
H11 Temperature of liquid nitrogen

H12 Rate of cooling and conservation of energy

Motion & Force

M01 - Introduction to motion detector
M02 - Practice predicting what a graph will look like
M03 - Practice reading a graph, making an equation for a graph
M04 – Using computer tools to understand your graph
M05 - Introduction to instantaneous velocity and acceleration
M06 - Motion with a constant force
M07 - Motion with 'NO' force
M08 - Test your understanding - I
M09 - Test your understanding - II
M10 - Equation of distance versus time for constant force
M11 - Relation between force, mass and acceleration
M12 - Gravity
M13 - Pendulum - I
M14 - Pendulum - II

Light & Optical Phenomena

L01 - Light emission from a bulb
L02 - Fun with shadows
L03 - View through a pinhole camera
L04 - Geometry of pinhole images
L05 – Reflection and images
L06 - Refraction
L07 - Refraction, ray diagrams and Snell's law
L08 - Introduction to lenses
L09 - Lenses and ray diagrams
L10 - Ray tracing and images
L11 - Eyes as an optical instrument and corrective lenses

PHYS 115 - Fall 2011 : Experiment Schedule

Aug 31	Introduction
Sep 06, Sep 07	Experiment # 1, 2
Sep 12, Sep 13, Sep 14	Experiment # 3, 4, 5
Sep 19, Sep 20, Sep 21	Experiment # 6, 7, 8
Sep 26, Sep 27, Sep 28	Experiment # 9, 10, 11
Oct 03	Experiment # 12
Oct 04	**Review**
Oct 05	**Exam I**
Oct 10, Oct 11, Oct 12	Experiment # 13, 14, 15
Oct 17, Oct 18, Oct 19	Experiment # 16, 17, 18
Oct 24, Oct 25, Oct 26	Experiment # 19, 20, 21
Oct 31	Experiment # 22
Nov 01, Nov 02	**Review**
Nov 07, Nov 08	Experiment # 23, 24
Nov 09	**Exam II**
Nov 14, Nov 15, Nov 16	Experiment # 25, 26, 27
Nov 21, Nov 22, Nov 23	Experiment # 28, 29, 30
Nov 28, Nov 29, Nov 30	Experiment # 31, 32, 33
Dec 05, Dec 06, Dec 07	Experiment # 34, 35, 36
Dec 12	**Review**
Dec 13	**Final Exam**

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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