Syllabus

Measurement and Analysis in Physics - Phys 199
Academic Year 2012/2013
Fall Semester 2012
Section 001, Schedule Code 597642
Section 510, Schedule Code 597692
Credit hours: 02
Prerequisites: none
Important Academic Deadlines:
`http://vip.sc.edu/cgi-bin/vip/general/session.cgi?TERM_CODE=201241&SESSION=C002`

Department: **Physics and Astronomy**
Instructor: **Dr. Yordanka Ilieva**
Assistant Professor
office: **712 Main St., office 711-C**
office hours: **Tuesdays, Thursdays 16:00–17:00**
e-mail: **ilieva@sc.edu**
phone: **(803)777-2887**

Class Meeting Times

The class meets two times in a week: Tuesdays and Thursday, 2 pm - 4 pm in PSC 202.

Course Description

Welcome to Measurements and Analysis in Physics!. This is an introductory experimental physics course for physics majors. The experiments cover topics from classical to quantum mechanics that will foster broad-based thinking about the exciting aspects of physics. Special attention is given to discussion of uncertainties of measurements and their importance for interpretating results of physics experiments.
Goals and Learning Outcomes: The general goal of this course is to introduce beginning students to established scientific standards and practices of measurements and data analysis used in modern experimental physics research and to build the understanding

- that all measured values have uncertainties and are not precise
- that "theoretical" values are typically not exact and do have uncertainties
- that even the most carefully planned procedure and quality equipment cannot eliminate measurement unceftainties
- of the purpose of finding a quantitative value of experimental uncertainty

A student who has successfully passed this course will:

- Know how to test physics concepts through laboratory experiments.
- Know how to plan a physics measurement.
- Know various methods for experimental data analysis, such as graphical and statistical methods.
- Understand the concept of uncertainty and will be able to apply statistical methods to estimate and report the uncertainty of an experimental result.
- Know how to use the estimated uncertainty to justify the conclusion of an experiment.

- Be able to identify and classify sources of error and uncertainty in the data and to rank the sources of uncertainties based on the quantitative analysis of their contribution to the total uncertainty (uncertainty budget).
- Be able to explain how each source of uncertainty could affect the result.
- Be able to identify the largest source of error and uncertainty in an experiment.
- Know how to present and interpret correctly results of experimental measurements using a meaningful number of significant digits.
- Be able to formulate a good scientific argumentation (coherent and convincing) by supporting claims with evidence through reasoning.
- Know the basic structure and content of a scientific paper presenting experiments and experimental results.
- Know how to prepare technical material for oral presentation to a group of peers.
- Know how to properly use and maintain laboratory log book.

This course is designed to help you achieve these goals and learning outcomes. I will do my best to help you understand the concepts presented at a level that will enable you to apply them to new situations. The pace of this course should allow you to understand the material in depth but it does move right along. Do not fall behind. Learning physics is no different from learning anything else. It requires your active participation. What you get out of a course depends on the productive effort and quality time you put into it.

Required materials

- Paper notebook of at least 80 sheets, size: 11×8.5 inches.
- Scientific calculator.
- Textbook: There is no dedicated textbook for this course. All the laboratory manuals and supporting material will be posted in Blackboard. For studying the physics concepts involved in the experiments and for reference, students can use *D. Halliday, R. Resnick, J. Walker, "Fundamentals of Physics", 8th ed., Extended (2008)* or *H.D. Young and R.A. Freedman, "Sears and Zemansky's University Physics with Modern Physics", 12th ed., (2008).*

Course structure

This course is designed to facilitate your participation by giving you several different environments in which to work. Those are listed below. Each of them is designed to accomplish different goal in your physics education. Some will be more natural to you than others but it is important that you participate actively in all of them. Preparing for a professional life means **learning how to learn** in as many different ways as possible.

During the Tuesday meetings, concepts of the topic of the week will be discussed (see *Schedule* for a list of weekly topics). Students will give mini-presentations on related physics subjects based on independent research. When possible, demonstrations will be performed. Students will conduct "inquiry-based" exercises, or work on tutorials, to discover and explore physics concepts involved in the experiment to be performed. Conceptual quizzes and open discussions are an integral part of the non-lab class meetings. In-class work consists of quizzes, tutorials, and summaries of in-class activities. In-class work will be always collected. Quizzes will be always graded, but other in-class work will be randomly selected for grading.

Typically, during the Thursday meeting a precision measurement or exercise on the weekly topic will be performed by the students. The goal of this session is an understanding of the quantitative measurement and its role in scientific interpretations. Students will do the experimental measurement in teams. Every student should keep a detailed log book during this meeting. An experimental paper should be turned in, in both electronic and paper form, typically on the following Thursday.

Students are entirely responsible for managing their learning process outside the class and organizing the team work on preparing their joint experimental papers.

A large part of the out-of-class course work is the experimental paper. Students should prepare an experimental paper for each experiment they have done during the Thursday sessions. With the exception of the "Drag Force" and "Magnetic Torque" experiments, each team will turn in one joint paper. For the two experiments mentioned above, each student will turn in his/her own experimental papers. Experimental papers are typically due one week after the experiment was performed. Detailed instructions about how to write a paper and what it should contain will be discussed in class and will be posted on Blackboard. Changes in due dates will be posted in Blackboard as well.

Several home-works will be assigned throughout the semester in order to provide exercise of particular skills, such as graphical representation of data, writing an abstract, *etc.*

During the last three class meetings, each student will present oral report on a physics topic covering the experiments performed during the semester. The

oral presentation should be 15 minutes long with a 5-minute question and answer session. Each student in the audience is expected to ask at least one question.

Recommended Study Habits

Readiness to learn means that you will come to class with questions and insights and prepared to discuss the relevance and application of course materials. Students who do well in this class also:

- Check Blackboard often for announcements and up-coming assignments and quizzes.
- Highlight reading materials as they complete pre-class assignments or take notes during class meetings and while completing reading assignments.
- Bring thoughtful questions to class for discussion.
- Have regular out-of-class meetings with their team partners to prepare due assignments.

Get the phone numbers of at least two classmates whom you can contact if you have questions or need help studying.

Course Requirements

- **Syllabus:** You are expected to read this Syllabus carefully and should know the course policies and requirements.
- **Class participation:** You are required to participate in group and in-class discussions and activities, perform eight laboratory experiments, prepare eight experimental papers, give an oral presentation and a mini-oral report, and complete pre-class assignments and assigned homeworks.
- **Attendance and other:** You are required to attend class, to complete the pre-class assignments before class, submit due coursework on time, and maintain up-to-date laboratory logbook.
- **Studying:** You are entirely responsible for managing your learning process outside of class. Just attending the TThu class meetings will not be sufficient for you to achieve the learning goals and outcomes of this course. You should

expect to spend in average around 8 – 9 hours in a week working on the course. This amount of time may vary depending on your background and current skills.

Policies, and Procedures

- **Responsibilities:** The University of South Carolina stipulates that enrollment in the course obligates the student not only for prompt completion of all work assigned but also for punctual and regular attendance and for participation in whatever class discussion may occur. Students are expected to attend each scheduled class meeting, to be on time, and to be prepared for each class session. It is the students responsibility to keep informed concerning all assignments made. Absences, whether excused or unexcused, do not absolve you from this responsibility.

- **Academic integrity:** The University of South Carolina has clearly articulated its policies governing academic integrity and students are expected to read and understand the University of South Carolina Honor Code in the Carolina Community Student Handbook and Policy Guide. Any deviation from these expectations will result in academic penalties as well as disciplinary action. The area of greatest potential risk for inadvertent academic dishonesty is plagiarism. Plagiarism includes, but is not limited to, paraphrasing or direct quotation of the published or unpublished work of another person without full and clear acknowledgment. Cheating and plagiarism are considered severe offense and will be dealt with according to the USC Honor Code. The minimum penalty for such offense is to fail the assignment; in the extreme case of repeated offense the penalty is to fail the course.

- **Classroom courtesy:** Cell phones, laptops, iPods, etc... must be turned off and stowed away during class time; there is no text messaging, web browsing, etc, during class. There will be no eating during class time. Beverages are permitted. Failure to adhere to these classroom rules may result in your being dismissed from class and/or an academic penalty. Class meetings end when the idea, concept, or technique under discussion has been concluded and the instructor has clearly indicated that the students are free to leave. For this reason class meeting may not end exactly at the end of class time. Every student is expected to respect fellow students and the instructor by

being attentive until the class is dismissed. **Packing up books, putting on coats, or standing up while the class is in progress** interferes with the learning of other students and **shows disrespect** for all members of the class and for the educational process. Those few students who know they must leave the class before the class ends should have the courtesy and respect to exit the classroom without disturbing the other students.

- **Attendance policy:** Attendance of the Tuesday and Thursday meetings is mandatory. Sign-up sheet at the beginning of Tuesday and Thursday classes will be filled. Missing n classes acquires $n(n-1)\%$ penalty which will be subtracted from the total score at final grading. Students who anticipate absences in excess of 2 of the scheduled class sessions due to an excused reason or due to participation in approved University-sponsored activities (for a list see the current academic regula- tions at http://www.sc.edu/bulletin/ugrad/acadregs.html) must contact me by 30 August 2012 in order to discuss their situation. When you miss class, you miss important information. If you are absent, you are responsible for learning the material covered in class. If you are absent when an assignment is due, you must have submitted the assignment prior to the due date to receive credit. Class absences will affect your grade. Due coursework cannot be made, except in the case of extreme illness or loss.

- **Punctuality:** Arrival of late students tends to disrupt the educational process and is disrespectful to your fellow students and your instructor. You are required to arrive in time for the class meetings. Penalty for late arrival may be implemented in case of repeated late arrivals.

- **Definition of excused absence:** Absence from class is excused for valid reason only (such as death in the student's immediate family, severe illness of a dependent family member, illness that is too severe or contagious for the student to attend class or temporary disability). In order for absences to be excused, you should both, inform the instructor AND present official letter regarding the reason for each absence, prior to the class that will be missed. Late excuses will not be accepted and the absence will be registered as unexcused. If your case is an emergency (accident or hospitalization) that you could not have anticipated, official letter regarding the nature of the emergency should be presented to the instructor at the first class meeting that you attend following the emergency. If you fail to present such a letter at the first next class meeting you attend, the absence will be registered as unexcused.

- **Missed Experiment, Oral presentation, or In-class work:** There is no make-up lab and no make-up oral presentation! If a laboratory experiment

is missed due to an excused absence (the policy defining excused absence must have been followed for an absence to be registered as excused), the student should submit an experimental paper using the data acquired by her/his team partners and will complete a quiz on the missed lab. If the final presentation is missed for excused reason (documental prove submitted to the instructor), the student will be required to submit her/his presentation slides AND an additional assignment decided upon by the instructor. If an in-class graded work is missed for excused reason (follow the definition of an excused absence), the results of the following graded in-class work will have double weight in the final grade.

- **Submission of due coursework:** Experimental papers and homeworks are due at times announced by the instructor in class or in Blackboard. Experimental papers should be submitted in both, electronic and paper forms. Homeworks can be submitted either in paper or electronic format.

- **Late coursework:** Course work which is turned in after the announced dead line will not be accepted. If an experimental paper is not turned in by the due date, a negative score equal to 50% of the maximum score that the missed paper would have added to the student's total score will be added to the latter, *i.e.*, if the paper on Magnetic Torque is not turned in, the student misses to add up to 8% to his/her score; in addition, his/her total score will be decreased by 4%. The total score loss is, thus, 12% - more than a full letter grade!

- **Grading Policy:** Students' work will be graded only according to the grading scale and standards explained in this Syllabus. Under no circumstance, will any student be graded according to different standards. In accordance with the USC teaching policies, re-examinations after the final for the purpose of removing an F or raising a grade will not be permitted. If at any time during the semester, personal or other circumstances arise that prevent you to perform at your best, and you anticipate negative effects on your academic standing, you should discuss immediately your situation with me, and more importantly, with your advisor, and consider withdrawing from the class. **All concerns, problems, and issues you have regarding your academic performance should be addressed BEFORE the last day of class. You cannot do anything to improve your grade after the class is over!**

- **Conditions for failing the course:** two or more missed labs

- **Open-Door Policy:** If any difficulties or problems arise in this course that interfere in any way with your learning or optimal performance, I would very

much like to hear about it. Please, stop by to see me at any time with any serious matter that you would like to discuss. For any less urgent matters, contact me via e-mail and an individual appointment will be granted to you. I will do my best to deal with problems promptly and effectively. I also appreciate hearing about the course from the students, and I encourage you to come by and chat any time you would like to. Please get in touch in person or by e-mail. **My doors are open!**

- **Classroom courtesy:** Cell phones, iPods, etc... must be turned off and stowed away during class time. There is no text messaging, web browsing, etc. during class. There will be no eating during class time. Non-alcoholic beverages are permitted only during non-lab class meetings. Failure to adhere to these classroom rules may result in your being dismissed from class and/or an academic penalty.

- **Academic Integrity:** The University of South Carolina has clearly articulated its policies governing academic integrity and students are encouraged to carefully review the policy on the Honor Code in the Carolina Community. Any deviation from these expectations will result in academic penalties as well as disciplinary action. The area of greatest potential risk for inadvertent academic dishonesty is plagiarism. Plagiarism includes, but is not limited to, paraphrasing or direct quotation of the published or unpublished work of another person without full and clear acknowledgment.

- **Accommodating Disabilities:** Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, email sasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.

Grading, grading scale and standards

Your level of achieving the course goals and learning outcomes will be assessed in the following graded components of classwork: experimental papers, laboratory logbook, in-class activity summaries, quizzes, mini oral reports, homework, pre-class assignments, and a final oral presentation. Your current and final score will be always evaluated in %, so that the Grading table below can be immediately applied. Graded course work will have the following weights in the final score:

- Graded components
  - Experimental Papers: 50% as follows
    Free Fall: 5%
    Pendulum: 5%
    Drag Force: 8%
    Archimedes Principle: 6%
    Electric Fields: 6%
    e/m ratio for the electron: 6%
    Magnetic Torque: 8%
    Lyman & Balmer line spectra: 6%
  - In-class quizzes: 5%
  - In-class tutorials and summaries of activities: 5%
  - Mini oral reports: 5%
  - Homework: 5%
  - Lab Logbook: 5%
  - Preclass assignment: 5%
  - Final oral presentation: 20%
  - Extra credit of up to 5% may be given for active class participation, such as giving short presentations of relevant findings in planning an experiment, writing an experimental paper, or introducing physics aspects of upcoming experiment. Every student will be given equal number of opportunities throughout the course to earn extra credit.

- Grading scale and standards

90% and up	A
85–90%	B^+
80–85%	B
75–80%	C^+
70–75%	C
65–70%	D^+
60–65%	D
below 60%	F

	Schedule	
Week	Date	Subject
1	Thu, 23 Aug	Welcome and Introduction to the course
2	Tue, 28 Aug	Statistics and Measurements
2	Thu, 30 Aug	Statistics and Measurements
3	Tue, 4 Sep	Newton's Laws; Gravity How to write an Experimental Paper
3	Thu, 6 Sep	**Free fall experiment**
4	Tue, 11 Sep	**Free fall experiment**
4	Thu, 13 Sep	**Free fall experiment**
5	Tue, 18 Sep	Pendulum
5	Thu, 20 Sep	**Pendulum experiment I**
6	Tue, 25 Sep	Pendulum Discussion
6	Thu, 27 Sep	**Pendulum experiment II**
7	Tue, 2 Oct	Fluid Dynamics
7	Thu, 4 Oct	**Drag Force experiment**
8	Tue, 9 Oct	Hydrostatics
8	Thu, 11 Oct	**Archimedes Principle Experiment** Last day to withdraw without WF assigned
9	Tue, 16 Oct	Discussion
9	Thu, 18 Oct	Fall Break - no classes
9	Tue, 23 Oct	**Electric Fields**
10	Thu, 25 Oct	**Electric Fields experiment**
11	Tue, 30 Oct	Magnetism
11	Thu, 1 Nov	**e/m** and **Magnetic torque** experiments
12	Tue, 6 Nov	General Election Day - no classes
12	Thu, 8 Nov	**Magnetic torque** and **e/m** experiments
13	Tue, 13 Nov	Atomic Physics
13	Thu, 15 Nov	**Lyman, Balmer Series** experiment
14	Tue, 20 Nov	Discussion
14	Thu, 22 Nov	Thanksgiving - no classes
15	Tue, 27 Nov	Discussion
15	Thu, 29 Nov	Presentations
16	Tue, 4 Dec	Presentations
16	Tue, 6 Dec	Presentations