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Physics Workshop/Lab Syllabus

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WORKSHOP GOALS AND PHILOSOPHY

Physics is an experimental science. Experiments are performed to test the predictions of theories or to present data the theories cannot explain in order to spur better theories.

If you find physics difficult, you are not alone. The concepts are often not easy to grasp. We must each construct our own models of understanding. Passive listening to lectures and rote memorization are not good ways to learn. We must be able to assimilate the concepts and apply them to predict further phenomena. Studies have shown that learning improves when a student thinks about a concept or problem by him/herself first and then discusses it with a small group of peers. That is the philosophy we will follow in this workshop. The abilities to work within a group of peers and to communicate ideas, both orally and in writing, are important skills to have. These are fundamental goals of this workshop.

Most of the experiments in this workshop will utilize data sensors interfaced to a computer. We utilize PASCO's Capstone software, because of its powerful ability to take, present, and analyze data. You will find most of the analysis tools you need in Capstone. You can find the area, highlight a particular region, find averages, or a host of other things with Capstone. You will find that you will normally be able to fit or model data with an analytic function. We will also make frequent use of Excel.

PURPOSE OF THE COURSE

The purpose of this workshop is to

- Help you learn to "think like a scientist",
- Teach you a systematic way of solving problems,
- Give you confidence in your ability to take measurements and adequately analyze and interpret data,
- Help you develop better oral and written communication skills,
- Introduce you to some important physical phenomena and concepts,
- Introduce you to proper laboratory procedures, the use of computers and data sensors, and teach you some basic laboratory techniques.

REGISTRATION

Physics 2419/1429 is a dependent course for Physics 2415/1425 respectively, but it is not part of Physics lecture course. It is a one-credit course with an independent grade.

Registration in Physics Lab will be blocked on Friday, January 20, 2017 8 AM. The labs start on Monday during the semesters first full week of classes (January 23, 2017).

Once registration is blocked, the course instructor, Dr. Maxim Bychkov (room 214 Physics building, 924-6843, mab3ed@virginia.edu), will be the **only** person who can add you into a section of the lab.

In that first week (the week of January 23, 2017), you must attend the section of your choice on time. If you are registered and attend your section, your place in that section is secure. If you do not attend or are late to your registered section, your name will be dropped from that sections enrollment and you may loose your spot.

Let us re-emphasize this point: If you are registered for a section and wish to secure your place in that section, you must attend that section on time during the first full week of classes.

After students registered for a section (who showed up on time!) have been added to the roster, those who wish to add to that section will then be added if space is available. Preference will be given to waitlisted students in the same order the names appear on the waitlist. Only 24 students may be in any given section. The remaining students must find other sections to attend.

In the extraordinary event that you cannot attend any sections during that first full week of classes (say due to major illness or a family emergency), please contact Dr. Bychkov as soon as possible, but absolutely before your scheduled section.

It is your responsibility to be registered for a workshop. If you are unable to find a workshop open that meets your schedule, go to a suitable section the first week to see if space becomes available or to see if someone will switch with you. You may need to go to several workshops before this is successful.

COURSE ORGANIZATION

Every student must purchase a voucher for Physics labs at the University bookstore. It means that you class will have an electronic copy of the manual available to you via WebAssign. Bring the voucher to the first lab meeting with you to gain access to the manual's electronic copy and the WebAssign access.

Your work in Physics Lab will consist of four parts:

1. A pre-lab homework that you must complete no later than 10 minutes before coming to the lab.
2. The lab itself, answering all the questions and predictions, and attaching data, results, graphs, and analysis. These results a due at the end of the lab period.
3. A group lab report due in 1 week after your lab meeting and it is due before the new lab period starts.
4. A post-lab quiz that you must finish within 24 hours following your lab meeting.

All types of assignments (including your electronic copies of the reports) will be submitted using the WebAssign Internet site. We will arrange the WebAssign access for you at the first meeting of the class. You won't have to purchase an additional access.

The labs meet during each full week of classes and are overseen by a graduate teaching assistant (commonly called a TA). The TAs responsibilities are to ensure a proper learning environment in the class. TAs are also responsible for safety of the students, protection of the equipment, providing additional instructions and information concerning the lab, grading your work and, together with the faculty, assigning your grade.

GRADING POLICY

The workshop/lab will be graded as follows:

- The pre-lab homework is worth 20%.
- The weekly lab is worth 40%.
- The post-lab quiz is worth 40%.

The grades for the assignments performed on WebAssign will be available to you at the end of the corresponding week via WebAssign gradebook. Your lab reports grades will be, ordinarily, finalized before the next week of the labs. Please contact your class instructor if you haven't received your grade for the lab report after 2 weeks following the original lab period.

Once your lab report has been graded, you have 2 weeks to inquire your TA about any deductions and to settle any grade ambiguities. **No lab grade will be changed past 2 weeks after your report was returned to you.**

Your final grades are determined by relative class rank, **not by a predefined numerical scale**. For example your final raw score of 90% does not necessarily guarantee an A in this class. The exact cut-off between the grades are determined by your class rank and vary substantially from semester to semester. Historically, the average grade has been between B and B+. Number of dropped assignments is subject to change from semester to semester.

PREPARATION BEFORE THE LAB

Before attending your lab section during the first full week of classes, look over the lab manual and become familiar with the appendices to which you should refer as needed throughout the semester. Particularly important is Appendix C: The Accuracy of Measurements and Significant Figures. Refer to Appendix C and apply it appropriately throughout the semester.

We are requiring you to spend time preparing for the lab each week. We expect that since you are better prepared, the lab will be a better learning experience.

In order to prepare for the lab each week, do the following:

1. Read over the lab write-up (including the relevant appendices) to get an overview of the material.
2. Work through any predictions and warm-up questions. It is not important that you get all predictions correctly, but it is important that you understand the basis for your conclusions.
3. For each lab, you must do the pre-lab homework (which will closely resemble the warm-up questions from your manual) that can be found on the **WebAssign** Internet site:

<https://www.webassign.net/uva/login.html>

Log in using your university computing ID and password. Complete the pre-lab homework no later than 10 minutes before your lab meets. The pre-labs are not pledged and

you are encouraged to work together to understand and solve the problems. However, you are responsible for really knowing how to work out the problems. Simply plugging numbers into a formula or spreadsheet given to you will teach you nothing.

PROCEDURE IN THE LAB

Normally you will work in groups of three. You will be assigned to a different group once every 3 weeks. A free exchange of ideas between group members (and also generally in the laboratory) is **absolutely essential** to your success in the lab. We expect you to share both in taking data, in operating the computer system, and writing of the report. Your TA will deduct points from your lab grade if you are not participating in the class discussion or not an active member of your group.

You must submit your electronic copies of the graphs, pictures of the apparatus, and your lab notes at the end of the lab period via WebAssign.

Each lab is **1 hour and 50 minutes** long. You are expected to have vacated the room within 1 hour and 55 minutes to allow the next section to begin on time.

AFTER THE LAB

You are expected to clean up your work place after you finished the lab. **Please leave the tables in similar or better conditions than you found them.** Repeated offenders of this policy will receive a penalty on their reports.

There will be a single report turned in per group for grading. One person is fully responsible for the bulk of the report writing and its timely submission. This person, a.k.a. "the writer", alternates every week. However **all members of the group must contribute to the writing of the report every week.** We suggest that the writer sets up a "Google Doc" or "Overleaf" collaboration, writes up the Abstract and makes a major contribution to every section of the report (Problem Solution, Exploration, Data analysis and Results, and Conclusions). Other members of the group **must** contribute with meaningful comments, organizing the graphics and weighing heavily in the Conclusion portion of the report.

All lab reports are due 2 days after the end of your lab meeting, no exceptions. The submission of the report will be done via WebAssign in an In-lab assignment every week.

ALL members of the group will get the same lab report grade based on that single report.

After attending each lab section you must do the post-lab quiz that can, again, be found on the **WebAssign** Internet site:

<https://www.webassign.net/uva/login.html>

Log in using your university computing ID and password. The post-lab quiz is a timed and pledged assignment. Therefore you may need to review corresponding materials before you begin taking the quiz. The post-lab quiz is due within 24 hours following your lab meeting. You are allowed to use your notes, books and lab manuals but are not allowed to use external help. Automatic extensions are available (see WebAssign Policy section below).

There may be an additional 13th post-lab quiz at the end of the semester. Although it may have questions based on the material through out the semester it is not a final exam and won't be carrying a separate weight towards your final grade.

TARDINESS

Late arrival for any lab session is very disruptive and will be penalized. After an initial five minute grace period, the TA will deduct 10% from your grade for the first ten minutes of tardiness and 20% for each successive 10-minute period (or part thereof). If you are more than 30 minutes late you will receive a 50% penalty on your lab report grade.

ABSENCES AND LAB MAKE-UPS SCHEDULING

Penalty free absences will be excused only for legitimate reasons such as **incapacitating** illness, a death in your family, a University sponsored trip, etc.).

An exam (or study session) for another course is NOT an approved reason to miss lab. If one of your other professors schedules an exam for the time that you have lab, you should inform them that you already have a class scheduled for that time and ask them to make appropriate arrangements. [You should, of course, do this as soon as the exam schedule is communicated to you.]

If you must miss a laboratory session, submit a petition explaining your situation and requesting permission to make up the lab. The request must be submitted via the following URL:

<https://feynman.phys.virginia.edu/request/>

Excused absences will, ordinarily, be granted a penalty free make-up.

In case of unexcused absences it is ultimately a decision of your instructor to grant you a make up. Should you be granted one, a penalty of 50% will be imposed on your lab report.

- **The request should be before the lab, not after.** Even in case you have a legitimate excuse you will not be granted a penalty free make-up if your petition was received after the beginning of your class.
- Make-up labs are held on Thursday afternoon. PHYS1429/2030 make-ups are held in Physics building room 212 beginning at 3 PM. PHYS2419 make-ups are held in room 215 beginning at 4pm. Special arrangements for different dates can be made only in case of extraordinary circumstances but are not guaranteed. It is your responsibility to communicate such circumstances to your instructor.
- You may only make up a lab during the week that you missed it or the following week. The labs are not left set up longer than the following week.
- If you were granted a permission to attend a make-up lab, you will be given an extension for the homework and the quiz. The make-up section TA will extend your pre-lab and post-labs. However you will have to check your WebAssign account periodically to see if the extension has been granted.

The make-ups are not guaranteed and it is ultimately the students responsibility to make sure that all guidelines to attend the make-up were followed.

If, for any reason, you are unable to keep up with assigned work, you are expected to withdraw from the course. Excessive absences will require notes from a doctor or medical professional.

WEBASSIGN POLICY

Large portion of your work in this class will be performed via the WebAssign interface. Therefore we felt it is important to dedicate a separate section to explaining WebAssign policies.

Please pay close attention to the due dates of the WebAssign pre-lab (aka homework) and post-lab (aka quiz) assignments. The pre-lab homework will always be posted week before the regularly scheduled lab. **The homework is due 10 minutes before the lab** (and no extension other than the one associated with a make-up will be granted).

You will be given 6 total submissions per question or part thereof to obtain the correct answer. First 3 submissions are penalty free and the WebAssign will indicate if you answered a question correctly after each submission. Every submission after the 3rd attempt will cost you 5% off the value of the question. After the 5th attempt the correct answer will be displayed to you and you can type it in for an additional 5% penalty. Before the dead line, no time limit is imposed on the pre-lab assignment. Do not waste your submissions. Seek assistance if you are having difficulty. Remember, the pre-lab homework is NOT pledged. Indeed, you are encouraged to work together. As noted earlier, though, you are expected to learn how to do the problem, not just work a calculator.

Work all your calculations out to several significant figures, at least 6. Submit your answer to WebAssign with at least 4 significant figures unless specifically indicated otherwise in the problem. Never round off any of your given numerical values or any intermediate values. Ignore the fact that you may be given a number accurate to only 2 significant figures. Assume it is 6 figures. WebAssign allows only a small error, therefore in chain calculations, an acceptable answer on an earlier part may not result in an acceptable answer in later calculations.

The post-lab quiz IS pledged and timed. You are allowed to use your book, notes, and manual (available in PDF form via the class website), but you are NOT allowed to consult anyone or use results from any previous years.

The post-lab quiz will be posted right after the lab (at the next hour mark). **The post-lab is due within 24 hours after you finished the lab.** The post-lab quizzes have a time limit of 60 minutes. This is an absolute deadline and if you do not submit the quiz on time, you will receive a grave penalty. Do NOT aim for the deadline.

You will be given 2 submissions for each question or part thereof of the post-lab quiz. After each submission WebAssign will tell you if your answer is correct. WebAssign always grades your last submission, so you must leave your answers in WebAssign after each submission. Do not wait until the last second to submit your answers or you may receive a zero. **Despite our warnings this will happen to several students during the semester, and they will receive a zero.**

Make sure that you not only *Save* but *Submit* your answers. The saved answers are not graded and are not stored by the WebAssign past the time limit of the quiz. You will receive a grade of zero for the questions you did not submit. **Despite our warnings this will happen to several students during the semester, and they will receive a zero.**

Once the post-lab quiz is started the time limit can not be changed, stopped or extended. Therefore, **never** begin your post-lab quiz if you think there is the slightest chance that you will lose electrical power, or your Internet connection e.g. from a thunderstorm. **Do not attempt** to "sneak a peak" at the post-lab that you missed, after the deadline. Once you clicked on the post-lab the clock will start running. As a rule of thumb, it is best not to click on the post-lab assignments in case there is any doubt. **Despite our warnings this will happen to several students during the semester, and they will receive a zero.**

IMPORTANT:

You may request an **automatic extension** for your post-lab on WebAssign if you missed the due date. Every post-lab will have an associated link, following which the extension can be requested. You must request the automatic extension within 22 hours of the due date. If you accept the extension, 30% will be deducted from your quiz score, and you must complete the quiz within a window of 2 hours that begins after you accepted the extension. (The time limit is still imposed so you must start the quiz within 1 hour, 10 minutes.)

CLASS POLICY CHANGES

Although we strive to discuss most situations encountered in the class in this Introduction, the class policy might change throughout the semester in some ways. In such cases the change of rules will be emailed to all students. A class website (also mirrored on the UVa Collab site) will also include the policy changes.