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| **PHYSICS 1600-02** | **PRINCIPLES OF PHYSICS II** | **SPRING 2020** |

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| **Instructor**: | Dr. Uwe Trittmann | **Email**: | UTrittmann@Otterbein.edu |
| **Office**: | Science 107 | **Phone:**  | 823-1806 |
| **Mailbox**: | Science 236 | **Assistant**: | Donna Rhodeback, Sci 236, 823-1316 |
| **Class Time:** | MWF 1:40-2:55pm | **Classroom:** | Science 304 |

**OFFICE HOURS**: Tentatively MWF 11:15-12:15pm, by appointment, or most any time you can find me. If you are making a special trip to see me you should probably call first to make sure I am in. Note that I am often off campus on Thursdays.

**CATALOG DESCRIPTION:** Hours: 4. Lecture and laboratory. A continuation of PHYS 1500. Electrodynamics, wave phenomena, and optics. Prerequisites: C– or better in PHYS 1500 or permission of instructor. Corequisites: MATH 1800.

**TEXT**: *University Physics* (13th edition)by H. D. Young and R. A. Freedman (Addison Wesley, 2012). You will need volume II for this course (volume I is needed for the chapter on waves).

**SUPPLIES**: A scientific calculator will be very useful. Please do NOT bring laptops, smartphones or other electronic devices into the classroom. Studies have shown that these devices are distracting and detrimental to learning during lectures.

**SUPPLEMENTS:** There is a PHYS 1600 web page at <http://faculty.otterbein.edu/utrittmann/phys1600> (there are no spaces in the address). Here you will find notices, copies of the concept questions from class, and links to other useful stuff, including tips on problem solving.

**PROGRAM LEARNING GOALS:** This course aims to fulfill the following general goals of the Physics program. Students should:

* Understand principles of electrodynamics (Ib)
* Be able to identify the essential aspects of a problem and formulate a strategy for its solution using mathematical, graphical, and conceptual representations as appropriate (IIa)
* Be able to apply appropriate techniques (mathematical, computational) to solve a problem (IIb)
* Be able to critically evaluate a solution for correctness, for example using estimation, examination of limiting cases, and dimensional analysis (IIc)
* Be familiar with standard lab equipment (IIIc)
* Be able to express in writing their understanding of physical principles, the results of experiments, and their analysis of physical problems (IVa)

**ASSIGNMENTS:** Your grade in the course will be determined by your performance on warm-ups, homework assignments, laboratories, and exams.

* **Warm-Ups**

Every day we meet (except for exam days) you will be given a few questions and simple exercises based on the reading for that day. Access these and submit your answers on-line at:

<https://otternet.site/warmup/2019Spring-PHYS1600-2/>

(This site is also linked at the course web site.) Responses are due by 1pm that day. You will not be graded on the *correctness* of your answers, but rather on your thoughtfulness and engagement with the material (2=good, 1=so-so, 0=nothing meaningful). The Warm-Up responses will also help me fine-tune the focus of the class for that day.

* **Homework**

Homework assignments are due **in class** on the dates shown in the schedule and have two parts. The first part consists of fairly straightforward problems to be solved on the online platform LON-CAPA, the second of more complex problems that need to be worked out and documented on paper. Both parts will carry roughly the same amount of credit.

To access LON-CAPA go to http://loncapa.otterbein.edu, and logon with your Otterbein email (example: utrittmann), and default password PHYS1600-02. You should change your password after you logged on for the first time. Select the ‘Student’ *role* and submit answers to the current questions. Typically, each problem will be worth one point.

For the written homework, please use white paper, with one problem to a side, and staple the pages together. **Homework that does not meet these requirements will not be graded.**

In preparing your solutions, do not just write down a final answer. Explain (in English) your reasoning and show intermediate steps. Be sure to note any assumptions you make, outside data you use, etc. The over-riding goal is *clarity* – anyone should be able to follow your reasoning. The ability to communicate your thoughts clearly is essential in the practice of science – it allows others to review and criticize your work. More generally, you will find that being clear in *presenting* your thinking will help you be clear in your *actual* thinking. It is a familiar experience of practicing scientists (and most others!) that they do not fully understand even their own work until they write it up for publication. Written problems will be graded on a 10-point scale as shown, and typically handed back at the next class meeting:

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|  | **3 points** | **2 points** | **1 point** | **0 points** |
| **Complete** | All parts present and fully developed | Some parts are incomplete | Major pieces are missing | Little meaningful work was done |
| **Clear** |  | Presentation is clear | Some aspects are unclear, e.g., coordinates not specified | Reasoning is totally unclear |
| **Correct** | No modeling or algebraic errors | Some errors | Serious errors | Almost nothing is correct |
| **Plausible** |  |  | Magnitude, sign, and units are all reasonable | Otherwise |
| **Initially OK** |  |  | No problems on the first pass | Otherwise |

Solutions to the homework will be distributed immediately after the class session in which it is handed in. After the graded assignments have been returned, you have the option to correct your homework **in different colored ink** and re-submit it at the next class meeting. Your re-submission can receive extra points **only** in the Clear and Correct categories. Note that, as a result, a complete but incorrect initial submission can still obtain 9 points out of 10 after corrections.

Since solutions are made public after the initial submissions, late homework cannot be accepted. Instead, late homework problems will be treated as correction submissions, with a maximum possible grade of 5 points out of 10.

The *online problems* are intended to mostly be relatively straightforward, involving only modest levels of synthesis and mathematical manipulation. Often exercises will involve only a single concept or formula, i.e., they may be rather “plug and chug.” These exercises should give you practice at a basic level, including practice in manipulating units and getting correct answers from your calculator. *Written homework problems* are generally rich and synthetic. You may find you need to combine several concepts or formulas, make reasonable assumptions, and sometimes pursue approximations. Such problems may contain too much (or too little) information, so that you need to decide what is necessary and what is not. Often they will have an algebraic solution, rather than a numerical one. The problems tend to be more challenging and foster a much deeper level of understanding. This is where most real learning will occur.

* **Exams**

There are two in-class exams and a comprehensive final, on dates shown in the schedule below. Exams are closed book and notes, except for a formula sheet that I will provide. These sheets will be made available to you before the tests to help in your preparation. Exams will contain problems similar to those on the homework as well as short-answer conceptual questions. The conceptual questions will be similar to questions we discuss in class.

* **Laboratory**

The labs are an integral part of the course. They are intended to enhance your understanding of physics by setting up experiments, predicting their outcomes, and appropriately documenting the results, i.e., by practicing the scientific method. They complement the lectures, which are of a more theoretical character.

**CLASS MEETINGS**: Much of the class time will be devoted to discussing the most difficult parts of the material in an interactive manner. Typically this will involve discussion questions that focus on underlying concepts, interactive demonstrations, and group problem solving. While your participation in these activities is not for credit, regular and consistent engagement will help you get the most out of the class.

**GRADING:** Your overall course score will be determined according to the following weights:

Warm-Ups 4%

Homework 15%

Laboratory 15%

 Two in-class exams 18% each

 Final exam 30%

Grades as assigned on an absolute scale, i.e., *there is no curve*. Letter grade thresholds are:

 88%+ A

 78-87.9% B

 68-77.9% C

 58-67.9% D

 < 58% F

I reserve the right to adjust these values based on class performance, but I will only move the thresholds *downward*, i.e., make it easier to get a better grade. No one will be penalized because others do well in the course.

**ATTENDANCE**: No make-ups for missed examinations are scheduled. If you must miss an exam for a foreseeable reason, you should contact me at least one week beforehand to make alternate arrangements. If you miss a midterm exam unexpectedly for a documented medical or legal reason, I will drop that exam from your course grade and increase the weight of the other exams to make up the difference. In all other cases a missed exam will receive a grade of zero. Note that exceptions to the final exam schedule are allowed only by permission of the Academic Dean.

**COLLABORATION**: I strongly encourage you to work together if you like on any of the class work except the exams (of course!). You will probably find that explaining things to others or struggling together to work through some problem will significantly deepen your own understanding. However, I do require that you use your own words in any work you hand in. Do not just copy either from a colleague or from a printed or online source. Any identical wording found in different papers will result in the credit for the problem being divided equally between the owners of those papers. Clear instances of copying from outside sources, or identical wording after the first offense, will receive a score of zero.

You should also cite any other sources you use, and acknowledge any help you received from sources. For example, in writing up the solution to a problem you might say, “Making the substitution y = ex (suggested by Molly C.), I find…”, or “In working this problem I benefitted from discussions with Joe M.” This kind of acknowledgement will never reduce your grade; and of course I have no way to check whether you have acknowledged everyone you should. I am just asking that, as a matter of intellectual honesty, you acknowledge those from whom you received help. This is standard operating procedure for professional scientists.

**Strategy for Success:** The topics that we will cover in PHYS 1600 are among the greatest intellectual achievements of human civilization. Don’t be surprised if you have to think and work hard to master this material! You will get the most out of this course (both intellectually and grade-wise) if you follow this time-tested system:

* Read assigned material *before* class. If you read it first, it’ll sink in faster during lecture.
* When reading, be deliberate. Don’t skim. Have a pencil and paper in hand and work through the derivations and examples in the book. Do the algebra yourself. Make note of points that are unclear and raise questions about them in class.
* Come to class. Stay involved during class and labs. Come to office hours.
* Start the homework early. Give yourself enough time to work and understand. Remember that it’s possible to have a perfect homework score by putting in the time and effort.
* But first, do the reading! Don’t try the homework until you finish the reading.
* Work together. Scientists often work in groups. You need to do your own thinking, but talking to others is a great way to sort out your thoughts.
* Don’t get behind. It’s very hard to catch up.
* Don’t give up!

The course web site has links to some collections of advice for physics students that you may find helpful. Particularly interesting is a 1949 booklet *How to Study Physics*, by Seville Chapman, a professor at Stanford University. It contains much useful advice on learning physics as well as more general advice on studying and college. It is also an entertaining glimpse into college life in that era.

**University policy on academic integrity:** All academic work should be your own. Academic dishonesty (plagiarism and cheating) may result in automatic failure of the assignment or the course itself, and you will be referred to the Academic Affairs Office for suspension or expulsion proceedings. You are plagiarizing when you:

1. Copy material from a source without using quotation marks and proper citation.
2. Follow the movement of the source, substituting words and sentences but keeping its meaning, without citing it.
3. Lift phrases or terms from a source and embed them in your own prose without using quotation marks and proper citation.
4. Borrow ideas (that are not common knowledge) from a source without proper citation.
5. Turn in a paper wholly or partially written by someone else.

The complete statement on Plagiarism, Cheating and Dishonesty can be found in the Campus Life Handbook, page 33, at the following web link:

<http://www.otterbein.edu/public/CampusLife/HealthAndSafety/StudentConduct.aspx>.

**Statement on disability services:** If you have a documented learning difference please contact Disability Services Coordinator to arrange for whatever assistance you need. Disability Services is located in Room #13 on the second floor of the Library in the Academic Support Center. You are welcome to consult with me privately to discuss your specific needs. For more information, contact the Disability Services Coordinator at 823-1618, or visit Disability Services at the following web link:

<http://www.otterbein.edu/public/Academics/AcademicAffairsDivision/AcademicSupportCenter/DisabilityServices.aspx>.

**Statement on Credit Hour Definition/expectation for student work:**

For each credit hour of classroom or direct faculty instruction, students are expected to engage in two hours of out-of-class course-related work (readings, homework, studying, project preparation, etc.). A four credit hour course thus requires eight hours per week of out-of-class work, on average.

**COURSE SCHEDULE (tentative and subject to change):**

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| **Date** | **Topic** | Reading | Assignment |
| M | Jan 13 | Oscillations and Waves | (review: 14.1-14.6) |  |
| W | Jan 15 | Waves | 15.1-15.4 |  |
| F | Jan 17 | Waves | 15.5-15.6 |  |
| M | Jan 20 | **MLK DAY – NO CLASSES**  |  |  |
| W | Jan 22 | Waves | 15.7-15.8 | Homework #1 |
| F | Jan 24 | Electric Charge | 21.1-21.3 |  |
| M | Jan 27 | Electric Charge and Field | 21.4-21.5 |  |
| W | Jan 29 | Electric Field | 21.6-21.7 | Homework #2 |
| F | Jan 31 | Gauss’ Law | 22.1-22.2 |  |
| M | Feb 3 | Gauss’ Law | 22.3-22.4 |  |
| W | Feb 5 | Gauss’ Law | 22.5 | Homework #3 |
| F | Feb 7 | Electric Potential | 23.1-23.2 |  |
| M | Feb 10 | Electric Potential | 23.3 |  |
| W | Feb 12 | Electric Potential | 23.4-23.5 | Homework #4 |
| F | Feb 14 | Capacitors | 24.1 |  |
| M | Feb 17 | Capacitors; Electric Field Energy | 24.2-24.4 |  |
| W | Feb 19 | Review |  | Homework #5 |
| F | Feb 21 | EXAM I |  |  |
| M | Feb 24 | Current | 25.1-25.3 |  |
| W | Feb 26 | Current | 25.4-25.5 |  |
| F | Feb 28 | DC Circuits | 26.1-26.2 | Homework #6 |
| M | Mar 2 | **SPRING BREAK – NO CLASSES** |  |  |
| W | Mar 4 | **SPRING BREAK – NO CLASSES** |  |  |
| F | Mar 6 | **SPRING BREAK – NO CLASSES** |  |  |
| M | Mar 9 | DC Circuits | 26.3 |  |
| W | Mar 11 | Magnetism and Magnetic Field | 27.1-27.3 |  |
| F | Mar 13 | Motion of Charged Particles in a B-Field | 27.4-27.8 | Homework #7 |
| M | Mar 16 | Biot-Savart Law | 28.1-28.3 |  |
| W | Mar 18 | Applications | 28.4-28.5 | Homework #8 |
| F | Mar 20 | Ampere’s Law | 28.6-28.7 |  |
| M | Mar 23 | Induction; Faraday’s Law | 29.1-29.3 |  |
| W | Mar 25 | Induction | 29.4-29.6 | Homework #9 |
| F | Mar 27 | Applications |  |  |
| M | Mar 30 | Displacement current; Maxwell’s equations | 29.7-29.8 |  |
| W | Apr 1 | Review |  | Homework #10 |
| F | Apr 3 | **EXAM II** |  |  |
| M | Apr 6 | Inductance | 26.4, 30.1-30.2 |  |
| W | Apr 8 | RC/LR/LC/LRC Circuits | 30.4-30.6 | Homework #11 |
| F | Apr 10 | **GOOD FRIDAY – NO CLASSES** |  |  |
| M | Apr 13 | Magnetic Field Energy | 30.3 |  |
| W | Apr 15 | Electromagnetic Waves | 32.1-32.3 | Homework #12 |
| F | Apr 17 | Reflection, Refraction, Polarization | 33.1-33.5 |  |
| M | Apr 20 | Mirrors & Lenses | 34.1-34.5 |  |
| W | Apr 22 | Interference | 35.1-35.3 | Homework #13 |
| F | Apr 24 | Diffraction | 36.1-36.3, 36.5, 36.7 |  |
| W | Apr 29 | **Final Exam (12:30-2:30pm)** |  |  |