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  Syllabus

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Phys1502-Hutson-Spring 2016

DESCRIPTION AND OBJECTIVES

Phys 1502 (used to be 113B) is the second part of a two-semester, calculus-based course in general physics that is specifically designed for students majoring in the life sciences. This will be a rigorous course in physics with a selection of topics and examples that life science students should find relevant. Topics to be covered include: electricity and magnetism; basic circuits; light and other electromagnetic waves; optics; special relativity; and modern atomic and nuclear physics. The course is appropriate for pre-med and other pre-professional students. In fact, many of our learning objectives are connected to the objectives outlined in the American Association of Medical Colleges' report *Scientific Foundations for Future Physicians (SFFP)*. Engineering majors and physics majors may take this course, but are advised that the Phys 1601/02 (used to be 116A/B) and Phys 1901/02 (used to be 121A/B) sequences may be more appropriate.

Co-requisites: a physics lab (1602L) and a calculus course (Math 1000, 1201 or 1301)

Click this link to access the [schedule of topics and reading assignments for the semester](#) (or [.pdf version](#)).

For each topic, we will start with concrete observations, build conceptual models that explain these phenomena, and then add on mathematical details. I certainly expect you to solve problems at an appropriately challenging level, but I also expect you to use your conceptual knowledge to reason about physical phenomena. Such reasoning requires a deep understanding of physics. Although the topics we will cover require algebra, trigonometry and calculus, don't be fooled – mathematical sophistication without conceptual understanding is not physics. I will emphasize both the conceptual and mathematical aspects of physics and help you build a firm foundation for your future studies.

Overall, I have 10 learning objectives for this course. The first four are content areas that I expect you to understand and use competently. The other six are best characterized as meta-content. Opportunities to practice these skills will appear repeatedly in both the course and associated lab. I want each student:

1. to understand and apply the fundamentals of electricity and magnetism (charges, forces, fields, potential, current, resistance, capacitance and inductance);
2. to understand the generation and propagation of electromagnetic waves (from gamma rays to visible light to radio waves);
3. to understand and apply geometric optics and interference phenomena in the visual system and in biomedical instrumentation;
4. to gain initial exposure and understanding of some principles of quantum mechanics

- (quantum uncertainty; wave/particle duality for matter and light; atomic and molecular energy levels; ionizing radiation; and radioactive decay)
5. to realize that (most) numbers have units – and are meaningless without such units – but that there are a few special and very informative dimensionless ratios;
 6. to competently estimate orders-of-magnitude for various physical parameters – even when given incomplete information;
 7. to fluently translate between multiple representations of data – verbal descriptions, pictures, diagrams, graphs and equations;
 8. to recognize that experiments have noise, error and uncertainty, but can still be designed to test theories and hypotheses; and
 9. to effectively determine when simple models are useful for understanding and predicting system behavior and when more complex models are required; and
 10. to apply physics principles to concrete problems in biology, medicine and the everyday physical world.

CLASS STRUCTURE. Over the last 20 years, several groups have looked very carefully at how students learn physics. They have found that student learning improves when students are actively thinking about physics instead of passively listening to a lecture. With that in mind, you will not hear much conventional lecture from me. **Your success in this course will depend on your active participation.** To encourage your active participation, I will use two tools: in-class “clicker” questions and pre-class “warm-up” questions (see below for details). Your participation (as measured by the clicker questions) will count 5% of your total grade. The warm-up questions will count as part of your homework grade. You can see how everything works together in this [schedule of a typical week](#).

CLASS TIME AND LOCATION. Tues/Thurs 11:00am-12:15pm in Stevenson Center 4309

CONTACT INFORMATION. Professor M. Shane Hutson,
Stevenson Center 6835,
343-9980 (office) or 319-0027 (cell, until 10 pm)
shane.hutson@vanderbilt.edu

OFFICE HOURS: Monday 4:00-6:00pm at the Help Desk; Friday 1:00-2:00pm in my office

REQUIRED MATERIALS

TEXT. P.R. Kesten and D.L. Tauck, *University Physics for the Physical and Life Sciences*, 1st Ed., Vol. 2

We will cover parts of chapters 16-27 this semester.

ONLINE HOMEWORK SYSTEM. [Sapling Learning](#)

When you bought the text for the course, you should have also received a *Sapling Learning Access Card*. Follow its directions to register with *Sapling Learning*. If you bought a used textbook or only want to use the eBook available inside the homework system, you can purchase online access directly from *Sapling Learning*. When registering, make sure to join the right section of the course. The “key code” for the course in Sapling should be the instructor’s last name: **Hutson**.

CLICKER. *TurningPoint ResponseCard*

These are the same clickers used across the Vanderbilt campus. I will ask “clicker” questions nearly every class and your responses will count as part of your final grade. See the Clickers page for more details.

GRADING POLICIES

Your grade for the course will be determined by a weighted average:

| | |
|------------------------------------|------|
| Midterm Exams (3 @ 20% each) | 60% |
| Final Exam | 20% |
| Homework | 15% |
| Participation (Clickers & Bonuses) | 5% |
| TOTAL | 100% |

If your average exceeds 90, 80, 70, 60 then you will be guaranteed at least an A-, B-, C-, D- respectively. At my discretion, I *may* curve grades up on a single exam or overall at the end of the semester. I will never curve down from the guarantees above.

MIDTERM EXAMS. There are three exams scheduled during the semester. These are scheduled with an in-class part that is largely multiple-choice or other short answer options ~~and a take home part that consists of two or three extended problems for which you have to show all your work. These problems are given as a take home exam so that you can take as much time as you need. You will be able to use your notes and the text on the take home portion, but you will not be allowed to work with your classmates or consult anyone else. Your take home exam answers must be your work and your work alone. The take home part will typically be due at noon on the Monday after the in-class part.~~ The target dates for the in-class exams are:

EXAM 1: Thursday, February 11

EXAM 2: Thursday, March 17

EXAM 3: Thursday, April 14

You will be able to replace your lowest mid-term exam score with your score on the final exam (see below).

FINAL EXAM. The final examination is scheduled for Tuesday May 3 at 3:00 pm.

The final exam is comprehensive and covers topics from throughout the course, albeit with some extra emphasis on material that comes after the third exam. Be aware of the final exam date when making end-of-semester travel arrangements. At present, I have no plan to offer an alternate final. Your grade on the final exam can be used to replace your lowest midterm exam grade (but only if it helps you).

GRADING ERRORS. The course TAs and I are human, and try as we may, will probably make some errors in grading exams. We will be happy to reconsider your score, but such requests must be made in writing. Obviously, if we added up your score wrong, your written request should just show our mistake. If you feel your answer was more correct than we gave you credit for, then your request must clearly state why this is so (We assume no one will make such a request if we mark a wrong answer right). Regrade requests will be returned without further consideration if the requests lacks a clear statement as to why more credit is deserved.

HOMEWORK. Homework sets in [Sapling Learning](#) are **due weekly on Tuesdays at 11:59pm**. You will have unlimited attempts to answer each homework problem. The *Sapling Learning* interface makes the problem solutions available after the due date, so late homework cannot be accepted. Students can request individual extensions of homework due dates, but these requests must be made BEFORE the assignment is due. Requests will be considered and granted at my discretion. If we are running substantially behind schedule in class, I may extend a homework deadline for everyone. If I do, I will send an announcement through Blackboard.

POLICY ON HOMEWORK COOPERATION. The purpose of the homework is for a student to learn how to solve the problems - solving problems is a measure of understanding the

material. Although the homework counts for 15% of your grade, it will have a greater impact on your overall grade via its impact on your learning and thus on your exam performance (80% of your grade). For many, the best way to learn the material is to do it yourself. If you do not get something the first try, and then you figure it out with hints, you will gain a lot in your understanding, particularly if you consciously think about what you did wrong on the early tries and why it was not correct. That said, the right group dynamics can also be helpful. The dynamics has to be such that every participant contributes and everyone is very stubborn about not moving on until they have a complete understanding. Notice that following the teacher or a friend is not sufficient understanding - you must be able to do the problems on your own. That is what you will have to do on exams. A clearly wrong group dynamic is having a friend solve a problem and you just copy it. This might add a little to your homework grade, but it will add nothing to your understanding, and hence nothing toward the 80% of your grade designed to measure this. Bottom line, you are responsible for understanding the material at a level where you can solve problems on a test in a reasonable amount of time. It is your responsibility to make sure whatever you do on the homework, you gain that level of understanding.

PARTICIPATION. *Active participation is crucial to your success in this class!*

5% of your final grade will be based on your participation via in-class clicker questions. This is just enough to move your overall grade by about half a letter grade. Over the course of the semester, there will likely be about 100-150 clicker questions (5 pts each). There will also be opportunities to earn large numbers of bonus participation points for completing assessments like the Physics 1502 Background Test (50 pts) and CLAS Survey (50 pts). Thus, there will be on the order of 500-750 total participation points available. You earn these points almost exclusively based on effort, but I do give a small bonus (7 pts instead of 5) for getting a clicker question right. Both the assessment and correct-clicker-answer bonuses should be seen as an opportunity to make up for missing a day or two of participation (I hope everyone participates everyday, but let's be realistic). As an example, suppose you answered 80 of 100 clicker questions (getting only 25 of the 80 correct). If you also completed both assessments, then you'd have $25 \cdot 7 + 55 \cdot 5 + 100 = 550$ participation points out of an expected $5 \cdot 100 = 500$ and you'd earn the full 5% toward your overall grade. Note that the bonuses cannot be used to earn more than the full 5% toward a student's overall grade. In past semesters, responses to Warm-Up questions were also included in your participation score, but since these are now being submitted via Sapling, they will instead be included in your homework grade.

CLICKERS.** As an aid to active participation, we will be using clickers (aka *TurningPoint* ResponseCards). It is important that you bring your clicker to every class. The clicker questions I will ask are a tool to keep you thinking about and doing physics in class. As such, I don't want you spending time busily writing down each clicker question in your notes. Instead, I will post all of the clicker questions after class (with answers) in [the course's site at Project Galileo's Interactive Learning Toolkit](#). This is a good resource to use when studying for the exams!

To correlate each student with a particular clicker ID, I need each student to register their clicker using the Turning Point Clicker Registration Tool (see menu on left-side in Blackboard). If you need to change your clicker at any point in the semester (occasionally one will stop transmitting), you can return to this tool and resubmit the form. Do not be tempted to submit clicker responses for someone else. Use of a clicker other than the one registered to you will be referred to the Honor Council.

WARM-UPS.** Your participation will also be graded by your submissions to warm-up questions posted on the course's Sapling Learning site (this is a change from previous semesters). Please note that these are PRE-CLASS questions. I will post two warm-up

questions at least two days prior to each class. One will be an open-ended question that the assigned reading will help you answer. The other will ask you to comment on what you found particularly interesting and/or difficult about the assigned reading. You should expect to answer such a pair of warm-up questions before EVERY class. Your answers are **due 2 HOURS BEFORE the corresponding class (technically at 9:00am)**. Answers will not be accepted after that time. I need this couple of hours to review your answers and adjust my plans for class time that day. I will respond to some answers in class and to others via email. In another change for this semester, the Sapling interface will allow you to see other students' responses after you submit your own response. Keep in mind that this means other students will also be able to see your response.

****If a student would like, special arrangements can be made with the instructor to do alternate work to replace the clicker and warm-up grades which together count 5% of the total grade. These arrangements must be made before February 1.**

POLICY ON CLASS RECORDINGS. You may take pictures and make audio or video recordings of class sessions, but only for your own personal use in studying. During study sessions, you may allow other students to view the recorded materials, but you must request explicit permission from me (in writing) to post or share these recordings or pictures with others outside the class.