PHYS 251 - Introductory Physics II –General Syllabus

Course Credits: 4. You must be registered for the lecture (251), recitation (251R) and the laboratory (251L) in order to earn credit for the course.

Prerequisite: PHYS 250

Instructor: Dr. Stephen J. Van Hook

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Course Description

Algebra-based introduction to classical electricity and magnetism, optics, and areas of modern physics, including such topics electric charge and fields, electrical potential and energy, electric currents and resistance, direct current (DC) circuits, magnetism, electromagnetic induction and applications to devices, electromagnetic waves, light and geometrical optics, wave nature of light, basic optical instruments (microscopes, telescopes, etc.), basics of quantum mechanics, applications of quantum theory to atoms, molecules, and solids, nuclear physics and radioactivity, applications of nuclear energy and radiation.

Course Goals & Objectives

I believe every student in this class can succeed if s/he is willing to put in the expected effort and uses effective study strategies. The LAs, TAs, and I are here to help you do that. So please don't hesitate to see us for help - everyone needs some help sometime and asking for when needed it is the wise choice. I've posted documents on Canvas on How to Succeed in PHYS 251, so please take the time to read them - I assure you that these tips will help you in this course. There are study strategies that are effective and those that are a waste of time - I want you to use the effective ones! In addition, for each exam, I provide a suggested study schedule that will help you on that exam if you follow it.

In this course, I want you to learn to think more like a physicist, to be able to break down a situation that initially seems complex into component parts and see the physics concept that applies to each part. I want you to be able to use these concepts fluently to be able to use them in your life (something you could do the rest of your life) and not *just* to solve homework and exam questions (something you are unlikely to do again other than on the MCAT).

In addition to the physics content itself (below), my larger goals for this course are that by the end of this course, you will better be able to:

1. Make careful observations and identify key details in a figure or text.

2. Make reasonable deductions from observations and be able to j them to another person.
3. Communicate scientific information clearly and engage in thoughtful discussions about concepts with peers.
4. Design and perform experiments to investigate a question about the world.
5. See the concepts from this course play out in your daily life.
6. Explain the concept described by an equation in words (the “why” behind each factor/term in an equation).
7. Analyze the structure of an equation to see how changing each parameter affects the outcome.
8. Solve complex problems involving multiple concepts or steps.
9. Use and operate on numbers fluently without a calculator (improved numeracy).

Each unit will have its own specific course objectives, but the broader course content goals are that at the end of the course, you will have a working (as in "can apply to your life") knowledge of how:

1. light rays travel in a straight line and how this explains shadows, what we can see through an opening, and how pinhole cameras operate.
2. we use parallax and angular size to judge distances of objects (i.e., depth perception).
3. light reflects off a smooth (e.g., mirrored) or rough surface and how this allows us to see other objects and our own reflection.
4. we 'see' virtual and real images using mirrors and lenses.
5. light refracts when entering a new medium (e.g., from air into water) and how that results in rainbows and is also the technology behind much of our long-distance communication.
6. lenses behave and how they can be used to correct for near- or far-sightedness and to magnify objects (e.g,. magnifying glass, microscope, telescope).
7. electric charges interact with one another (e.g., when you rub a balloon in your hair and it then is attracted to your hair) using the complementary ideas of electric force, electric field, electric potential, and electric potential energy.
8. electric current moves through an electric circuit (and the role of electric potential and resistance in determining this flow) and how electrical energy is provided and used in a circuit (and be able to connect this to devices you use and your own electric bill).
9. multiple elements in a circuit can be connected, which arrangement would make sense for a given application, and be able to determine the role of switches and fuses in the circuit.
10. electrical energy can be stored in a capacitor and the capacitor can give a circuit time-dependent behavior.
11. moving electric charges and magnetic dipoles interact with each other using the magnetic field, and how this interaction is the basis behind important technologies we use every day.
12. we generate electricity using the principle of magnetic induction.
13. electromagnetic waves are created and their basic properties, including polarization.

14. electromagnetic waves (e.g., light) can interfere with one another and how this is useful in identifying substances (spectrometry) and create colorful patterns or determine uniformity of material's thickness (thin film interference).
15. light waves can also be viewed as a stream of particles (photons) and particles have wave-like behaviors, leading to discrete energy levels and spectral lines.
16. transitions in the nucleus can result in high-energy "ionizing" radiation and its properties and health impacts.

Required Text

You will need to have a copy of ***College Physics: Explore and Apply*** **by Etkina, Planinsic & Van Heuvelen, 2nd edition**. This course will cover Chapters 17-25 and parts of 27-30. This soft-cover (three-ring binder) PSU custom “split” with these sections is available at the bookstore. You will also need to purchase access to the .ExpertTA homework system (you can purchase directly on the website) - to set up your account on the system go to this page . In addition you want to have an i>clicker with which to participate in lecture. These are available from the bookstore and elsewhere.

You should also bring to lecture a notebook and writing utensil, as well as a ruler for when we are doing optics (the first 5 weeks). Having multiple colored pens/pencils will be especially helpful in the first two units on optics. I will post some lecture pages on Canvas the day before each lecture that would also be highly beneficial to have with you in lecture.

You will need a basic scientific calculator (with trig/log functions) for the laboratory, homework, and occasionally for recitations. You will not need a calculator for lecture and calculators are not allowed on the exams.

Schedule of Activities

See the detailed schedule of lecture topics, recitations and laboratories at the end of this document. Generally every week there will be two "lectures" (each with a set of pre-lecture questions [PLQ] due before each lecture by noon), one problem set on ExpertTA., a recitation activity, a laboratory activity, and optional Learning Assistant practice session. There will be two midterms (Wed 2/13 and Wed 3/27, both 6-7:15 pm) and a final exam (TBD by the Registrar).

Note that all times and deadlines are for the local time in State College, PA. If you are traveling to another time zone during the semester, be sure to plan accordingly (e.g., if you are visiting California in the Pacific time zone, something due at 11:59 pm will need to be done by 8:59 pm your local time in California).

Lecture

On Canvas you will find a page for each lecture session with the textbook readings, additional information, and a link to the PLQ due for that class. "Lecture" will be spend

having you discussing problems with other students and so come to class expecting to work - and work collaboratively. In order for you to be able to do the problems in class (and succeed in the course), you will need to come to class prepared - that is, having done the required reading (you will need the textbook for this course) and completed the pre-lecture questions on Canvas. In lecture, we will be using many types of activities: (1) Multiple choice “Clicker questions” to help identify common misconceptions and provide feedback during the class. They are designed to help you know when you understand the topic at hand, and me to know when more discussion is needed and when to move on to the next topic. (2) Collaborative worksheets where you work with your classmates to answer problems and may turn in the answers on paper during lecture. (3) Peer Review problems where you answer a question on your own and then you and a classmate swap papers and review each other's work.

Much of your work in the course outside class will be *preparing for lecture*. In lecture, we will work to clarify and solidify your understanding of the material from your pre-lecture preparations and you will spend much of the time working with other students on analyzing and discussing problems – it won’t be me talking a lot of the time. (Just as in a Shakespearean literature course, class is about discussing the reading you do before class.) If you don’t do the preparation beforehand, you won’t get much out of lecture and will have difficulty succeeding in the course. Canvas lists readings in the textbook before each lecture. In addition, I will provide other resources (e.g., a web link, a video, or some presentation slides) for each lecture that will supplement the textbook. You should review those after doing the reading. For each lecture, there is a “pre-lecture” set of questions on Canvas for you to answer (Two-thirds of the credit for this will be based on participation and one-third will be based on correctness of your answers). I will use your responses on these questions to finalize what we do in lecture. (If everyone seems to understand topic A, we won’t spend time on it; if many people are confused on topic B, we’ll focus class on that topic.)

Laptops and cell phones are not permitted in lecture. If you have need of a laptop for some reason, please see me before lecture on Tuesday to discuss your situation. You are also requested not to use phones or other devices during class (other than for taking notes) since they are distracting to you and all those around you and research has shown that using your phone (or laptop) in class reduces your grade and the grades of those around you (so it's both bad for you and rather rude to your classmates).

Laboratory

Laboratory sections meet once a week in room 208 Osmond. Your meeting time is determined by your 251L section number. You must attend the laboratory section in which you are scheduled — no switching is permitted.

The laboratories are designed to provide you with hands-on experience with the material being investigated in class. Laboratory instructors lead the laboratory sessions and act as your guides as you explore the material. You will work collaboratively in three-member lab groups to carry out the experiments. The experiments are in the Laboratories folder.

During the lab session, your group will prepare a single write-up, addressing specific points of the experiments. This write-up must be submitted by your group before the end of the laboratory session and all group members must be present when the report is submitted in person to the laboratory instructor.

All phones and electronic devices must be put away during laboratory. If you are using your phone during laboratory, the TA is permitted to ask you to leave and you will not get credit for the activity (or be allowed to sign up for a makeup).

Recitation

Recitation sections meet once a week. Your meeting time and location is determined by your 251R section number. You must attend the section for which you are registered. No switching is permitted.

In these sections you will work collaboratively in three-member groups to complete problem-solving exercises or small experiments.

The recitation activities are available on Canvas. While only one paper is turned in for each group, every student needs to bring an individual copy of the pertinent activity to the recitation section.

All phones and electronic devices must be put away during recitation. If you are using your phone during recitation, the TA is permitted to ask you to leave and you will not get credit for the activity (or be allowed to sign up for a makeup).

Problem Set assignments

The weekly problem sets will be on ExpertTA. The problem set will usually cover material covered the previous week and in lecture Monday of that week. Access can be purchase online or in the bookstore (more expensive than online). There is a 2 week grace period so you don't need to purchase a code immediately. You will need to follow this link to set up your account. (If the system says it doesn't see you in the class, wait a day and try again - there is a delay in student rosters synching between Canvas & ExpertTA.)

The system allows you to submit your homework at any time between when the assignment is visible to students (usually 2 weeks before the due date) and the due date. Assignments are generally due Fridays at 5 pm, though I will give everyone a grace period of 2+ days (until Sunday 11:59 pm). However all work completed by the Friday 5 pm deadline earns 10% (technically: 9.89%) extra credit when I transfer the grade from ExpertTA to Canvas. Before the midterms, the due dates will be the time of the main exam (instead of Friday 5 pm), with the (no-extra-credit) extension still until Sunday night (the material is on the exam, so you will want to do it by the due date!). You can submit each question (and even parts of questions) at a time - I recommend that you do *not* wait to submit the entire assignment at once.

You are encouraged to work together and collaborate on weekly problem set assignments, but work submitted for individual assessment must be the work of the individual student. Please refer to the Academic Integrity Policy below. You are *strongly encouraged* to come to office hours to work on the problems there with both me (or a TA) and with other students.

In most cases, you will have multiple tries to arrive at the correct answer. For numerical problems, you will usually get five attempts, with reduced credit after the second attempt (losing 10% for each submission after the second one). For multiple choice problems, you have one attempt fewer than the number of options (whichever is less), with reduced credit after the first attempt (and losing a percentage of grade dependent on how many options are given).

Any work done after the due date will not receive credit and no extensions (beyond the automatic one explained earlier) will be given for any reason. Because problem sets are available over a week before the due date and can be done in advance, no excuses are allowed for missing or late problem sets (see bottom of page for more info on excuse policy). Technical problems just before the deadline are not grounds for an extension – so don't wait until the last minute! I will probably not be available to answer any questions on the material between the Friday 5 pm deadline and the Sunday 11:59 pm extension, so be sure to do the work early and be able to ask the questions you have on the material.

Some of the assignments will require the use of "PhET" programs. Many of these will also run on the iPad using the $0.99 "PhET Simulations App".

Examinations

There will be two midterm exams and a cumulative final exam (date to be set by the Registrar). Exams will be closed book and closed notes. Relevant physical constants and formulae will be provided. Calculators, cellular phones, smart phones, any other communication devices, tablet computers, and organizers, and additional paper are not allowed. The exams serve to assess your understanding of the physics concepts and thus will have few numerical calculations and all will be ones that you should be able to do without a calculator. Room is provided for scratch work in the exam booklet. The exams are a mixture of multiple-choice questions (the majority of the exam) and several open-ended questions. You will need to bring a #2 pencil for the Scantron and your PSU ID with you to each exam.

The exams will be based on the assigned reading in the textbook, the material covered in lecture, the recitations, the laboratories, and the homework assignments. Please see the Course Content Objectives for more information about the content assessed on the exams in this course. All exams are cumulative, but focus on the material not already tested on a previous exam. Because of this cumulative nature, each subsequent exam is worth more than the previous one.

About a week before each midterm exam, you will have the opportunity to sign up for a Self Check Quiz at the eTesting Center in Pollock. Taking this "Pre-Midterm" quiz will

help you better assess your preparation for the exam and guide your studying efforts for the exam itself. If you do better on the midterm than on the quiz (or choose not to take the quiz) then your score for the quiz will be your score on the midterm. In other words, the quiz can only help your grade - it can't bring down your grade.

Grading Policy

Your grade in the course will be based on your performance in the labs, in recitation, on the problem set assignments, and on the exams with the following weights:

- Pre-Lecture Questions (PLQs): 4.5%
- Problem Sets (ExpertTA): 10%
- Recitation: 10%
- Laboratory: 10%
- Pre-MT1 Quiz: 2%
- MT1: 16%
- Pre-MT2 Quiz: 2%
- MT2: 18%
- Final Exam: 25%
- World in Conversation: 2%
- Concept Survey (pre): 0.5% (participation)
- *Extra Credit:* Concept Survey (post) 0.5% (participation) + *up to* 1% on post-survey based on performance *if* did *both* pre & post surveys

Final letter grades for the course will be based on an absolute scale. The final course score will be rounded to the nearest integer (e.g., 89.49 rounds to 89; 89.5 rounds to 90). No curving of any kind will be employed unless the combined average exam score (computed as the combined average of all midterm and final exams taken to date) is less than 70%. In such cases, the grades on the most recent exam will be adjusted by additively raising the exam scores to allow the *combined* exam average to meet the target minimum of 70%.

The break points for the various grade levels are:

- $93\% \leq A \leq 100\%$
- $90\% \leq A- < 93\%$
- $87\% \leq B+ < 90\%$
- $83\% \leq B < 87\%$
- $80\% \leq B- < 83\%$
- $77\% \leq C+ < 80\%$
- $70\% \leq C < 77\%$
- $60\% \leq D < 70\%$
- $F < 60\%$

You are responsible for verifying all of your scores (with the exception of the final exam score) before the final exam for the course.

ExpertTA : You need to earn at least 90% on a given assignment to earn full credit for that assignment. So do not worry about missing an occasional fraction of a point due to not getting the answer correct right away - you don't need all the ExpertTA points to get full credit for the assignment. The most important thing is to make sure you can do the problem well enough that you could explain it to someone else by the time you finish the problem set. The assignments will generally be due Fridays at 5 pm, but when allowed by University rules, I will give an automatic extension until Sunday nights (11:59 pm). Assignments right before the midterms will be due the night of the midterms and won't be extended. I will award 10% extra credit for any work done by the deadline on Friday 5 pm, so I encourage you to do the work by then. (In addition, it will be difficult to get help after Friday afternoon.)

Pre-Lecture Questions [PLQ's]: These are downloaded in 3-week blocks, consisting of 6 lectures each (except the first block with is only for weeks 2 and 3). These scores are scaled by a factor of 6/5 (4/3 for the first 2-week block) and then truncated to 100%, which means that forgetting one PLQ in a 3-week block will not hurt your grade (assuming you are doing well on the others). Because of this cushion, please do not request to have a missed pre-lecture assignment excused (it's already built in) for any reason. This score is based 1/2 on correctness and 1/2 on participation and you get two submissions. You will see two categories in the Canvas gradebook: "PLQ" and "PLQ Blocks". The "PLQ Blocks" are the grades that are actually used in your final grade and are posted every 3 weeks. Note that the first PLQ block is worth half as much as the others.

Class participation (clickers): We are using clickers (code is AD) solely for creating an interactive environment, not for taking attendance, so there are no "clicker" points in the course. However, there will be occasional opportunities for extra credit that may require lecture attendance on that day to earn. If you missed lecture that day for any reason, there is no way to make up that missed extra-credit opportunity.

Concept Survey: You will have the chance to take two concept surveys in the course. The first one you will take at the beginning of the course (1/10 or 1/11) and is graded only on participation (for 0.5%). The second you one will take near the end of the semester (4/16 or 4/17) and will be graded both on participation (0.5% extra credit) and on correctness (up to 1% extra credit if you also took the pre-survey, with your score determining what percentage of the 1% extra credit you earn). You will get an email from the eTesting Center about scheduling a time for each of these surveys. You must schedule a time and attend the time you sign up for - we will only offer makeups under the most extreme conditions (e.g., hospitalization).

World in Conversation: World in Conversation (WinC) is a Center for Public Diplomacy that facilitates dialogues *for* Penn State students *by* Penn State students. These dialogues are meant to expand perspectives and invite greater understanding on topics that are relevant, complex and often contentious. No one will tell you what you *should* think; instead they will ask you to express what you *actually* think. **You will have the opportunity to participate in a facilitated dialogue as a part of this class.** Each session is 95 minutes in duration and will occur outside of your regular class meeting times. One week before the sessions for this class begin, you will receive

an email explaining how to register. This email will be sent to your PSU account. In order to receive credit, your attendance will be recorded. But keep in mind: You will not be able to attend the program (or receive credit) if you are more than 5 minutes late. Students with last names beginning A-L will have dialogues during weeks 4-8 (expect an email in week 3). Students with last names beginning with M-Z will have dialogues during weeks 9-13 (expect an email in week 8). WinC participation is worth 2% toward your grade in this class.

Academic Integrity

As described in **The Penn State Principles,** academic integrity is the basic guiding principle for all academic activity at Penn State University, allowing the pursuit of scholarly activity in an open, honest, and responsible manner. We expect that each student will practice integrity in regard to all academic assignments and will not tolerate or engage in acts of falsification, misrepresentation, or deception. To protect the fundamental ethical principles of the University community and the worth of work completed by others, we will record and report to the office of Judicial Affairs all instances of academic dishonesty.
The University and Departmental policy regarding academic integrity can be found on the course web page with links to the faculty senate policy .

Disability Policy

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources(SDR) Web site provides contact information. for every Penn State campus.
In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation as per the SDR guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Excuse and Makeup policy

Laboratory and Recitation Makeups

The laboratory and recitation components of this course are structured around collaborative learning. You must be present in laboratory or recitation to do these assignments. If you are absent from a laboratory or recitation section with a valid excuse, as described under "Valid Excuse Policy", **fill out the makeup request form on Canvas immediately after the absence**. You will be required to make up the missed activity the week after the absence (on the Canvas form you select when you will make up the activity). Your score for the missed activity will be recorded as a zero

until the activity is made up. **You may only make up three activities during the course of the semester.** If you are absent without a valid excuse, a score of zero will be recorded for that assignment, and you will not be allowed to make up the activity. If you are more than ten minutes late to a lab or recitation, you cannot receive any credit for that period's so be on time (and lateness is not a valid reason for requesting a makeup)!

Problem Sets Makeups

You must complete the ExpertTA problem sets as scheduled. The Problem sets are available early so no excuses are accepted. Even technical problems are not valid excuses, as explained earlier in this document.

Exam Makeups

All students should plan to take their exams at the scheduled times. Students can request conflict exams only by filling the conflict exam signup form on Canvas in a timely manner (i.e., before the deadline, which for midterms is usually about a week before the exam). In the case of sudden or unexpected events that will cause them to miss an exam (such as serious illness), students are required to notify the course administrator prior to the exam (or as soon as is reasonably possible *if* it is not possible to contact the course administrator before the exam). Failure to do so will result in a zero on the exam without an opportunity for a makeup exam. A makeup exam must be taken as soon as possible (usually within 2 days of the exam) and, in extreme circumstances, within a week of the exam.

Pre-Midterm Quizzes and Concept Survey Makeups

Since a missed Pre-Midterm Quiz will be overwritten by the midterm grade, there are no makeups allowed for a missed quiz for any reason. If you miss the concept survey (either pre- or post-), I cannot promise that I can schedule a makeup, but I'll try if you see me in person in a timely manner (i.e., right away) and you have a valid reason for missing the survey (forgetting to attend a time signed up for or waiting too late to sign up are not valid reasons).

Valid Excuse Policy for Makeup Requests

- Requests to make up a missed evaluative event due to reasons that are based on false claims is cheating and will be treated as described in the Academic Integrity Policy 49-20.
- The student must provide all requested information on the Makeup Form on Canvas and electronically sign the form. Incorrect or missing information will result in the request to make up an absence to be denied.
- Family emergencies include a death in the immediate family, death of a close friend, sudden hospitalization of a close family member, and events of similar gravity.

- For university-approved curricular and extra-curricular activities, a student needs to obtain a letter (or a class absence form) from the unit or department sponsoring the activity. The letter must indicate the anticipated absence dates, and it must be submitted to the course administrator along with the first makeup request before the first absence.
- In the case of religious holidays, students should submit the makeup request before the date of the absence.
- ***Since University regulations require course instructors to make conflict exams available to students, missing a laboratory or recitation due to an examination in another course is not considered a valid reason for missing a course activity. You must submit the makeup form right away in order to makeup the activity the following week; otherwise the request will be denied, barring extenuating circumstance (e.g., an extended hospitalization) – in such circumstances, contact the course administrator directly.***

Counseling Services

The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS) : 814-863-0395

- .Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
- Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational Equity/Report Bias

Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined at http://equity.psu.edu/reportbias .