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Physics 142 Electricity and Magnetism Fall 2015

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Physics 142 Fall 2015

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michael.roedelbronn@gmail.com Use all three when initiating contact to ensure quickest response time.

Office Hours: immediately after class, or by apt, some weekend time slots.

Text: *Fundamentals of Physics, 10th edition, extended, by Halliday, Resnick and Walker.* You will use this text during quizzes and some labs, so it is a good idea to bring it to class. There are two published versions of the text, one of which is called 'Extended' and includes material necessary for this course. The 'extended' part of the text may go unnoticed for 141 and 142, but you'll notice the missing chapters as you approach the second exam for 143.

Some recommended supplementary material:

Study Guide to accompany Fundamentals of Physics, by Thomas Barrett

Schaum's outline of College Physics, by Eugene Hecht

Lecture notes for University of Illinois course Physics 212 and 213

Physics for Scientists and Engineers, 2nd edition, by Randall Knight

Physics for Scientists and Engineers, 6th edition, extended, by Tipler and Mosca

Prerequisite: PHY 141 or equivalent; Calculus 2 or equivalent.

Materials: You will need a calculator that can do algebraic and trig functions, as well as statistical functions. A TI calculator is preferred. There's no guarantee the instructor will be an expert in using your particular calculator, so you will need to know all about how to use it, particularly statistics.

Disclaimer: I will attempt to refrain from altering the schedule or other contents of this syllabus significantly. However, I may need to make minor adjustments as the semester evolves. Any changes will be announced in class and repeated via COBRA announcement and a class e-mail. You should check COBRA frequently. I repeat: check COBRA frequently. At the very least, check it on Monday and Wednesday afternoons and once over the weekend. Outside class itself, it will be my primary means of making course announcements.

Also, be advised I have a 'day job' in addition to teaching at Parkland. If I am a few minutes late, just wait. If I am more than 10 minutes late (this has only happened four times in six years), have someone check COBRA, because there will be an announcement there, providing a new estimated start time.

Content: This course explores the physics principles of thermodynamics, electricity and magnetism. We start with taking the elements you studied in Physics 141 (or the equivalent) and using them to understand the behavior of gases. Atoms and molecules are moving fast and they bump into the walls of this room. In so doing, they create pressure and temperature. Using principles of mechanics, we can derive a connection between the movement of molecules and the temperature of the environment. And an increase in temperature causes molecules to move faster and possibly expand their domain (expansion). Systems in contact with one another can exchange this energy (by conduction, convection, or radiation) and engines can be designed to systematically take energy from the environment (stored in chemical bonds) and release it to create kinetic energy which is then used to do work. The first and second laws of thermodynamics govern the exchange process and the efficiency with which engines perform.

Next we look at the physics of electric charge and the principles that govern such things as holding atoms together (Coulomb's Law) and the systematic movement of charges through materials (Ohm's Law). We will use the force principle and free-body diagrams to look at static arrangements of charges and movement of charges with constant acceleration. Systems of charges with special symmetry create unique electric effects (Gauss's Law) that can be exploited to create special electronic components. We'll use the energy principle to look at the conduction of charges through material. In lab, we'll explore electricity using various instruments such as power supplies, signal generators, voltmeters, ammeters, and oscilloscopes.

The latter section of the course is devoted to principles of magnetism. Moving charges create magnetic fields (Biot-Savart Law, Ampere's Law), so we can make a magnet out of a systematic conduction of electricity. Other moving charges that feel the presence of magnetism experience a force, so we have forces between conducting systems. With clever design, we can use this magnetic interaction to cause rotation of an electric circuit and make a motor. A changing magnetic field can induce a voltage in a circuit (Faraday's Law) and so cause the generation of electricity. This creates an interesting interplay between the electricity and magnetism components of the course.

I expect you to have already learned good problem-solving techniques in PHY 141, so I will not spend much time on those basics in this class. See the handout on problem solving tips posted on COBRA. I will also not spend much time reviewing concepts from PHY 141. I expect you to be proficient with concepts and problems involving Newton's Laws, Conservation of Momentum (linear and angular), Conservation of Energy. If you are weak in any of these areas, be sure to plan for some individual review time during this course. There are questions which are very difficult if you do not have a firm command of this material. In particular, if you do not have a very good grasp of all the material in chapters 1 - 12 of the textbook, you will need to brush up. More than anything else, I have seen, in general, that the most trouble arises from a poor working knowledge of the material in chapter 9 (Center of Mass and Linear Momentum).

Overall Schedule

A detailed version of this is posted on COBRA in an Excel spreadsheet, so you know what will happen for every day in the class. Any changes will be announced on COBRA, which you should check at least three times per week. "I didn't know that's what we were doing today" is, therefore, never a reasonable statement.

<u>Week</u>	<u>Chapter</u>	<u>Topic</u>
8/25	18, 19	Ideal Gas Law
9/01	19, 20	
9/08	18, 19	
9/15	20	Exam I (Sep 17)
9/22	21, 22	
9/29	23	
10/06	23, 26	
10/13	24	Exam II (Oct 13)
10/20	25	
10/27	26, 27	
11/03	27	Exam III (Nov 5)
11/10	28	
11/17	29, 30	
11/24	31, 32	<u>THANKSGIVING BREAK</u>
12/01	31	Exam IV (Dec 3)
12/08	--	LRC circuits, Course review
12/15	--	Final Exam (Dec 15, 18:15)

Reading, Quizzes, Exams, etc.

I don't want to simply lecture and repeat what is in the textbook. Research conducted over the past 40+ years shows that having an instructor simply repeat textbook material is not an effective way for most students to learn, nor is it the best use of our classroom time. Have you ever taken a literature course? The teacher does not spend classroom time reading works of literature, but rather assigns that reading to be done prior to class so that class time can be spent discussing that material. This is a difficult transition from the traditional engineering style, and I haven't fully made it yet myself. It is my expectation that you will do some preparation before we discuss a topic in class. The posted day-by-day schedule gives what textbook chapters and sections will be discussed on any given day ('ch' on the schedule). Before that class, I expect you to have completed the reading assignment. This includes not only reading the chapter, but understanding the sample problems and trying to answer the Checkpoints as well as the end-of-chapter Questions. You should also try to start a homework problem or two. With this level of preparation, we can make better use of our class time. I will use the 'lecture' time to emphasize chapter highlights or items that I've seen give people particular trouble, answer questions and perhaps work through some example problems and problem-solving strategies, time permitting. Note that everything in the text is fair game, whether or not I cover it in class, unless I specifically announce otherwise either in class or on the posted schedule. Also fair game is material I cover in class that it not in the text. If you read the chapter prior to class, you'll easily recognize such material on your own.

Homework will be assigned as follows: I will post the homework assignments under the Homework section of CONTENT on the course's COBRA page. There will be several required homework problems for each chapter, due on the given dates. Detailed grading will not be performed. However, I have found if I don't collect something, homework won't be done by many students, frequently those that would most benefit, and I have seen performance and learning suffer as a result. I will only do a spot check. Homework solutions will be posted on COBRA. If you hand in the homework after the posted due date but before the exam, you will get half credit. After the exam on that material no credit will be given for late homework.

There will be two types of quizzes given in this course, reading quizzes (rQ on schedule) and review quizzes (Q). Reading quizzes will be 8 questions, generally 7 multiple choice questions plus one terminology question, based on your reading of the material prior to lecture, worth up to 5 points each. This reading quiz will be taken prior to lecturing on the material, will be of 10-12 minutes duration, and will be done individually.

During the next discussion class period following presentation of a chapter, there will be a review quiz (Q) based on material from the previous lecture and homework. These quizzes are graded on a 5 point scale. Both types of quizzes are individual work. Review quizzes will be around 15 minutes long and are generally closed book.

Immediately following classroom discussion of a topic, you will have the immediate opportunity to work some problems in small groups. These problem sets are worth 20 points each. You will work in groups of 3-4 people, and these should take around an hour. Generally, these are due at the end of the class period, unless announced otherwise. Discussion problems (DP on the schedule) will typically be similar to or at least related to the homework assignment for that chapter. These discussion problems will be around an hour long and are fully open note/open book. Note the word 'group.' This does not mean you sit around the table and work problems individually; it means you should work as a group. If you plan to miss a session, I can get you a copy to work on for early submission, but no late submissions will be accepted. Read that last sentence again, and plan accordingly.

There will be 3 exams of approximate duration 90-110 min during the semester. These exams will be approximately 30-35% conceptual type questions/short problems and 65-70% long problems. The final will be identical in format and slightly longer than the mid-term exams. You will have the entire 3-hour class period for all exams.

There is a cumulative **final exam** for the course: **Tuesday, 15 Dec 6:15-9:15pm**

Extra Credit

See the handout posted on COBRA for the general policy.

<http://physics.illinois.edu/outreach/saturdayphysics/>

<http://www.ece.illinois.edu/calendar/saturday.asp>

<http://www2.parkland.edu/planetarium/scienceLectures.html>

<http://eoh.ec.illinois.edu/>

<http://www.visitcampaigncounty.org/calendar/date/parkland-regional-science-olympiad-tournament>

Laboratory

We will keep lab groups at no more than four students each, and if the number of setups can support, group size will be limited to three. See the Lab Expectations handout for more specifics. I consider the ideal lab group for these labs to be three people, with the exception four people for the phone cord lab.

It is important that you arrive on time to begin your lab session. If you join after 5 minutes into the class without making prior arrangements with me, your grade for that lab will be reduced.

Lab reports must be handed in before you leave the lab with the exception of the SHM/Springs and Virtual Objects labs. You're working in groups, so please help each other. Lab grades given are out of 20 points total. Further details regarding lab expectations and grading are provided in a separate document.

Data that you include must be legitimate data collected during the lab session. Lab reports from previous semesters will not be allowed into the lab rooms.

Lab reports which are copied in full or in part will be considered cheating and may result in a failing grade for the course.

No food or drinks are allowed near the lab equipment. I don't have a problem with drinks at your desks, but the first time I have to clean up after someone, that policy will be changed.

<u>Week</u>	<u>Laboratory</u>
8/25	Ideal Gas Law
9/08	Thermal Expansion, Specific Heat
9/15	Heat of Fusion
9/29	Equipotential Surfaces
10/06	Resistivity
10/20	Series and Parallel Circuits
11/03	RC Circuits
11/10	Specific Charge
12/01	RL Circuits
12/08	LRC Circuits

Grades

The grades are compounded in the following way:

Midterms	36%
Final Exam	28%
Labs	15%
Quizzes (reading)	5%
Quizzes (review)	5%
Discussion Problems	6%
Homework	5%

Letter grades will be assigned as follows: A - 90%, B - 80%, C - 70%, D - 60%.

You must earn 60% on the laboratory part of the course to receive a passing grade for the course.

You must also receive a score of at least 60% on the final exam to receive a passing grade.

People actually have failed this course for skipping too many labs. PLEASE do not let that happen to you... People have also effectively lost an entire letter grade for skipping too many classes in general. Keep in mind EVERY time we meet, there are points involved.

I will drop your lowest midterm exam, your lowest lab of the semester, and your lowest grade in each remaining part of the course (discussion problem, review quiz, reading quiz).

There will be no make-up quizzes, exams, or labs under any circumstances. Before continuing stop and read that last sentence again. Now, one more time... Come to me if you have questions. Otherwise, I do not expect anyone to ask if they can make up any of those items. If you know you will miss a class, you can do discussion problems, quizzes, and homework problems *early*. Approved and documented absences due to medical reasons, death in the family, etc. are, of course, unpredictable, and allowances will be made. However, exceptions to the red statements themselves will not be made.

You have the means to calculate your grade with the above information. Please do not ask me to determine 'how you are doing.' You are capable of doing that yourself. I will calculate grades twice - once for the midterm grade and once for the final grade. Since all the exams are not done, the midterm calculation will be weighted differently: 65% exam average, 10% reading quizzes, 5% review quizzes, 10% discussion problems, 10% labs.

Exam grading - I tend to be generous with partial credit if you follow a clear process for trying to solve a problem, using the skills you learned in PHY 141. If you have a genuine question regarding what you did wrong, you should not hesitate to ask. If you believe I graded a problem improperly, write the problem number and a description of what you feel was done wrong. Hand that in to me, along with your exam, and I will do a detailed regrade. I am not perfect and may miss things. Note that, although I certainly consider genuine concerns along those lines, I have little patience with people simply trying to gain extra, unearned points, so be advised regrades can go either way - there is no guarantee you will not lose points.

Other resources

PHY 212, 213 supplemental materials from University of Illinois

Mechanical Universe: <http://www.learner.org/resources/series42.html?pop=yes&pid=565>

www.wiley.com/college/halliday

www.wolframalpha.com

Wikipedia (although generally reliable for technical topics, never trust as sole source)

<http://phet.colorado.edu/en/simulations/category/physics>

<http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>

Extra help

I should be your first resource for help outside class itself, if practical. Never hesitate to ask if you need help, in person or via e-mail. Unfortunately, given that I work full time, my availability during the week for office hours is extremely limited, although I will occasionally be available on Saturday or Sunday afternoon. For convenience, these sessions will generally be conducted at the Champaign Public Library, and I'll try to hold 3-5 during the semester. They will be announced on COBRA. Even though I'm not around during the week, the instructor of the daytime section (Dr. Carl Lorenz) can be consulted. There is also a peer tutoring program here at Parkland. I wish I could provide more time during the week, but I simply can't. That is not an excuse not to seek extra help.

Center for Academic Success

If you find yourself needing assistance of any kind to complete assignments, stay on top of readings, study for tests, or just to stay in school, please contact the Center for Academic Success in D120 at 353-2005 or 351-2441. You may also email the CAS at CenterForAcademicSuccess@parkland.edu.

Disability

Students with approved accommodations through the Office of Disability Services are expected to meet privately with instructors to discuss accommodations listed on their Disability Services ID card. (e.g. extended time on exams, notes, etc.) This personal introduction officially marks the beginning of your accommodations for the semester. Instructors should be allowed to view your Disability Services ID card and note approved accommodations.

Reader/Scribe and Extended Time Testing Accommodations are not accessible in the classroom. Students should work with Disability Services staff to schedule tests/quizzes with accommodations.

If you believe you have a disability for which you may need an academic accommodation (e.g. an alternate testing environment, use of assistive technology or other classroom assistance), please contact: Cathy Robinson, Room X148, 217-353-2082, crobinson@parkland.edu.

Academic Honesty

There has been an increase in the frequency of cheating incidents in recent years, although I am fortunate to have never had to deal with it myself. The Student Policies/Procedures Manual defines cheating, fabrication, and plagiarism. Consequences can carry the penalty of a failing grade for the course and possibly suspension from the course.

Parkland College's values include honesty, integrity, and responsibility. Students, faculty, and staff are all expected to maintain academic integrity in their work and take collective responsibility for preventing violations of intellectual ownership. Academic dishonesty is unacceptable, and the institution is committed to helping students learn these values through development and growth. Personal commitment, honest work, and honest achievement are necessary characteristics for an educated person. The process of determining the consequences of academic dishonesty begins with the faculty member and may proceed to include the department chair and/or the Office of the Vice President for Academic Services. All Incidents of academic dishonesty, including developmental or punitive action, should be referred in writing to the Office of the Vice President for Academic Services.

Academic Honesty can be broadly defined as performing academic work without cheating, fabrication, or plagiarism:

a. **Cheating:** Using or attempting to use unauthorized materials, information, or study aids in any academic activity. Submitting as one's own work term papers, homework, and examinations that are not one's own work or for which a student received unauthorized help. Copying the work of another, or allowing another to copy one's own work, without proper acknowledgment.

b. **Fabrication:** Falsifying or inventing any information or citation in an academic activity.

c. **Plagiarism:** External information borrowed and directly quoted must be indicated by use of quotation marks, and any changes, omissions, or addition to the direct quotation must be shown in bracket, and the source documented. All cited external information that has been paraphrased and summarized must also be documented.

d. **Collaboration:** Students at Parkland College are encouraged to work together on group projects, study, and other activities. However, work submitted to fulfill an assignment not specifically identified as a group activity must be substantially the work of the author. Instructors should provide guidelines to students to maintain the academic integrity of these collaborative activities. Collaboration beyond this constitutes academic misconduct.

For a full explanation of the consequences of academic dishonesty, please visit

<http://www.parkland.edu/Media/Website%20Resources/PDF/StudentPolicy/Student%20Policies%20and%20Procedures.pdf#page=5&zoom=100,0,300>

Core Values

I believe strongly in the Core Values espoused by Parkland College: Honesty and Integrity, Fairness and Just Treatment, Responsibility, Education, and Public Trust. Essentially, these values set guidelines for how we should treat one another. Failure to be respectful of one another or to maintain ethical behavior will not be tolerated. All Parkland Students are expected to be responsible for their behavior. This includes monitoring your language and your behavior all around the campus, including in and out of classes. Please, think before you act! You are expected to respect yourself, your fellow students and your instructors. You have joined the Parkland College academic community. Be a good member of the community.

View the Student Policy and Procedures Manual and Conduct Code on line at www.parkland.edu/studentLife/policies

If you have questions or concerns, call the Office of the Dean of Students at 353-2048.

Drops/Withdrawals

If you are registered for the class as of the start date and have not attended class for any of the course meetings for the first week (Aug 25, 27), you will be dropped with no refund of tuition or fees unless special arrangements have been made by then. After Aug 31, you should not plan on an instructor withdrawal if you want to withdraw from the course. You are ultimately responsible for your own withdrawal by the withdrawal date.

Final date to voluntarily withdraw from the course without a failing grade is Dec 4.

You are also responsible for reading and understanding the Fall 2015 Syllabus Addendum, which can be found on the front page of the course COBRA page or at this URL:
https://cobra.parkland.edu/shared/shared_content_files/syllabus_addendum.html