Physics 133.01 – Physics II: Electricity, Magnetism, and Waves - Fall 2020
MWF 8:00 - 8:50 AM

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Required Primary Text:

- Young and Freedman, University Physics with Modern Physics, 14th Ed., with MasteringPhysics. If you did not purchase MasteringPhysics with the text, you can buy it online at http://www.MasteringPhysics.com/.
- Physics 133 Laboratory Manual

Course Website:

We will use Moodle – http://moodle.lafayette.edu. "**PHYS 133.01-Fall 2020 Phys II:Elect, Magnet & Waves**" should be in your list of current courses. Handouts, homework assignments/solutions, supplemental articles, etc., can be downloaded from this site.

Course Overview:

This course is a calculus-based introduction to the foundations of electricity and magnetism, intended for students majoring in science or engineering. Our emphasis will be on identifying, understanding, and applying the fundamental principles of electric fields and potentials, basic circuits, magnetic fields, and electromagnetic waves.

Student Learning Outcomes: After completing this course, a student should be able to

- understand that the goal of physics is to comprehend phenomena in the physical world;
- to demonstrate the ability to formulate a testable hypothesis based upon acquired physical data;
- collect and analyze experimental data relevant to testing a hypothesis;
- evaluate whether the evidence supports, refutes, or leads to the revision of the hypothesis;
- to create, interpret, and critically evaluate graphs, tables and models of physical data;
- understand scientific uncertainty and how it is reduced with additional data acquisition and hypothesis testing;
- distinguish between scientifically testable ideas and opinion.
- understand, identify, and apply the fundamental principles of physics in a variety of physical situations;
- use both qualitative reasoning and quantitative problem-solving skills in applying those principles;
- apply Maxwell's equations and the principles of waves to appropriate physical situations; and

- to engage in the process of doing physics, including such tasks as developing and testing models, interpreting experimental data, solving problems, and communicating results.

Co/Prerequisites:

You must have credit for Phys 131 or 151; Math 162 or permission from instructor

In Case of Inclement Weather/Loss of Internet during COVID:

I will leave a message on Moodle announcements which will push an email to the class. This happened a few times in semester 1 of COVID.

Course Policies:

Attendance is mandatory and I encourage you to read the relevant sections of the text (as listed in the schedule) before class so that the material is not completely unfamiliar to you when we start discussing it together. A significant component of this course will involve in-class problem solving; these activities are designed to help you better learn the material and, as such, require your presence in order to be effective.

Grading:

Your grade will be based on:

Homework:	20% total	Exam 1:	18.33%
Participation	10% total	Exam 2:	18.33%
Labs:	15% total	Exam 3 (Final):	18.33%

All grading mistakes have to be resolved within one week after the homeworks or examinations are returned to the students. Please do not wait to contact me if there is an issue

Laboratory:

The laboratory is an essential part of this course. There you will see and experiment with many of the concepts we cover in class and learn how to approach, analyze, and communicate details of an experiment. You must complete all of the assigned experiments; you will be unable to pass this course unless you **both** attend all laboratory meetings **and** receive a passing grade for the laboratory part of the course. Further details will be provided by your laboratory instructor.

Assignments:

Problem Sets: Homework will be assigned on a weekly basis and will generally be due on Wednesdays at 8AM Easton time). Late assignments are generally not accepted, unless you have received an exemption from me ahead of time. Please plan to manage your time accordingly.

Weekly problem sets will consist of a selection of online problems available through Mastering Physics (see separate Mastering sheet on Moodle).

A few notes about assigned problem sets:

- It is to your advantage to do the assigned homework. I have chosen the problems to help you learn the material. Physics can be a complicated thing, but repeatedly working with it (and at it) is essential in order to gain physical intuition and get comfortable with the mathematical theory.
- I encourage you to work on these problem sets collaboratively, though I do expect you to take 10-15 minutes to give a problem "the old college try" on your own so you enter into discussion with others having some ideas to contribute. You will make your life easier as well as improve your understanding if you work with others (either by explaining it or having it explained to you).
- Though the problem sets consist of online problems, you should still need to write down what you're doing. I recommend keeping a notebook where you can clearly show your work when solving a given problem. It will serve as an excellent study tool for exams and if you come to office hours for assistance, I will expect to see your work so that I can help.
- Some tips and pointers for doing problem sets that will help keep your work clearly and logically organized are below. These steps are not required, but I guarantee that you will find your work easier to follow, explain to others, and learn from if you adhere to these suggestions.
    - Write out the problem (or an abbreviated version containing all relevant information). Draw a picture/diagram if useful.
    - Clearly work out the problem, commenting your work as you go. Solutions should never contain just the math; use words to describe what you are doing and to reference where in the text an equation came from and why it is relevant.
    - Remember to keep track of units (by writing them out with all your calculations)! Do the units work out as you expect they ought to at the end of a problem? Dimensional analysis is the easiest check to ensure you have tackled the problem correctly.
    - Box your final solutions or major milestones as you do the problem. This makes it easier for you to follow your own work when you look it over.
    - Think about or comment on the significance of your answer. (Does it make sense? Is it what you expected? Why or why not?)
    - Please see me if you have any questions about this! I know it seems a bit ridiculous listed out like this, but I promise that it will serve you well in the long run. Writing in science is different from the traditional humanities paper, but the point is the same: to clearly and effectively communicate something. This will help you to accomplish that, even with online assignments.

Exams:

There will be two in-class exams and a third exam which ill take place during finals week. For each exam, I will provide you with an equation sheet which will be made available ahead of time so you may familiarize yourself with it. On the exams, I want you to demonstrate that you know and understand how to apply the concepts/formulas from class; I want you to focus on the physics, not on memorizing a bunch of equations.

The idea is that you will use your study time to focus on the fundamental ideas and to practice solving problems rather than to memorize complicated formulae. However, you will do best if you know the material well enough to have in mind the formula you need before you look for it on the equation sheet; use the sheet just to remember where the factors of 2 and π belong. The goal of the course is to understand and be able to use the basic physics principles, rather than to memorize how to solve specific types of problems. Accordingly, exam problems will not be identical to any particular homework problems, but they will be based on the same principles and can be solved using similar strategies. Practice on the homework problems will be essential in developing the skills and solid understanding of the principles needed to do well on the exams.

To reinforce this emphasis on understanding, the tests may include short answer questions that stress the underlying principles, somewhat similar in spirit to the questions at the end of each chapter.

Participation:

Your participation within lectures is essential to you learning the material, practicing/developing your generic quantitative skills, and learning how to break down complicated physics problems similar to those you will encounter on the homework and exams! The quizzes in lecture are to help you break down problems and allow me to see where students are having issues – they are not graded.

Collaboration:

Collaboration among students on homework is not only allowed, it is very much encouraged! However, any work you turn in must be written by you, in your own words, and faithfully represent your understanding of the course material. Collaboration on exam questions is **never** permitted. Directly copying homework solutions or exam answers will result in a zero for the assignment or exam to failure for the course, depending on the severity and subject of the academic violation. I expect that you will abide by the "Principles of Intellectual Honesty" appearing in the Lafayette College Student Handbook.

Course Outline: note the chapter and sections associated with lecture

	Monday	Wednesday	Friday
Week 1 – Aug 17	Coulomb's Law 21:1-3	Electric Fields 21:4-5	Continuous Charge Distributions 21:6-7
Week 2 – Aug 24	Electric Flux 22:1-2	Gauss' Law 22:3 **PS1 Due**	Applications of Gauss' Law 22:4-5
Week 3 – Aug 31	Electrostatic Potential Energy 23:1-2	Electric Potential 23:3 **PS2 Due**	Equipotential Surfaces 23:4-5
Week 4 – Sept 7	Capacitance 24:1-2	Electric Field Energy 24:3-5 **PS3 Due**	Electric Current 25:1-2
Week 5 – Sept 14	Ohm's Law 25:3-4	Energy and Power in Circuits 25:5-6 **PS4 Due**	**Exam 1**
Week 6 – Sept 21	Kirchoff's Rules 26:1-2	RC Circuits 26:4 **PS5 Due**	Magnetic Fields 27:1-3
Week 7 – Sept 28	Magnetic Forces on Charges 27:4-5	Magnetic Forces on Currents 27:6-8 **PS6 Due**	Biot-Savart Law 28:1-4
Week 8 – Oct 5	Catch-Up/Worksheet	Catch-Up/Worksheet	Ampere's Law 28:5-6
Week 9 – Oct 12	Applications 28:7	Faradays' Law 29:1-4 **PS7 Due**	Induction 29:5-7
Week 10 – Oct 19	Inductance and Magnetic Field Energy 30:1-3	RL and LC Circuits 30:4-6 **PS8 Due**	Mechanical Waves 15:1-5
Week 11 – Oct. 26	Superposition 15:6-8	Sound Waves 16:1-4 **PS9 Due**	**Exam 2**
Week 12 – Nov 2	Resonance 16:5-7	Electromagnetic Waves 32:1-3 **PS10 Due**	Energy and Momentum in EM Waves 32:4-5
Week 13 – Nov 9	Reflection and Refraction 33:1-3	Polarization and Scattering 33:4-7 **PS11 Due**	Interference 35:1-2
Week 14 – Nov 16	Thin Film Interference 35:4	Diffraction 36:1-4	Diffraction Gratings and Circular Apertures 36:5-7 **PS12 Due**

Final Exam Time TBD by Registrar

Additional Resources:

There are a variety of resources available to help you in your study of physics. These include my office hours, tutoring through HUB (formerly ATTIC), and working with classmates, and SI sessions.

I encourage all of you to seek help when needed. Generally, the earlier you come the better the results. Interacting with students has been and remains a source of great satisfaction for me – please stop by via Zoom!

Accommodations:

In accordance with Lafayette College policy, reasonable academic accommodation and support services are available to students who have a documented disability. It is your responsibility to provide me with the appropriate paperwork from the Accessibility Services Office. More information is available at https://hub.lafayette.edu/disability-services/.

Gender Inclusion:

This is a gender-inclusive classroom. I have been provided with a class roster and your legal names. I will gladly honor any requests to be addressed by a different name or pronoun than appears on the class. Please make me aware of any preferences.

Moodle Privacy Statement:

Please note that Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Common Course of Study Outcomes Statement:

This course (and particularly the lab component) will promote the following outcomes for Natural Sciences (NS) within the Lafayette Common Course of Study:

- NS 1: Employ the fundamental elements of the scientific method in the physical and natural world by identifying and evaluating a testable scientific hypothesis.
- NS2: Create and evaluate descriptions and representations of scientific data via equations, graphs, tables, and/or models.

Federal Credit Hour Compliance Statement:

The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office web site (https://registrar.lafayette.edu/wp-content/uploads/sites/193/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc) for the full policy and practice statement.

Proper Usage of Course Materials and Classroom Recordings:

At Lafayette College, all course materials are proprietary and for class purposes only. This includes posted recordings of lectures, worksheets, discussion prompts, and other course items. Reposting such materials or distributing them through any means is prohibited. Such materials should not be reposted or distributed through any means. You must request my permission prior to creating your own recordings of class materials, and any recordings are not to be shared or posted online even when permission is granted to record. If you have any questions about proper usage of course materials please ask me. Please also be in contact with me if you have any concerns with being recorded during the course.

Online discussions in Moodle occurring during synchronous class sessions should also remain private and not be shared outside of the course. Courses using Moodle will make student information visible to other students in this class. Student information in courses is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure of student information to unauthorized parties violates federal privacy laws and it must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.