Course Syllabus

Course Title:	PHYS 125 Physics for Engineers II
Prerequisites:	PHYS 031; MATH 022 or MATH 023; concurrent enrollment in MATH 121
Class Meetings:	M, T, W, Th 1:00-3:00 pm EST July 6th - August 13th via **Microsoft Teams**
Instructor:	Dr. Catherine Miller
Email:	Catherine.Miller@uvm.edu
Office Hours:	TBD via **Microsoft Teams**
Teaching Assistant:	Kenneth Shepherd Jr.
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Office Hours:	TBD via Microsoft Teams

Course Description

In this course, we will explore the fascinating subjects of electricity, magnetism, and optics. In the first half of the course, we'll investigate the fundamentals of electrostatics including topics such as electric charge, electrostatic forces, and electric fields. We'll learn how to derive expressions for the electric field, electric potential energy, and electric potential for various charge distributions. Then, we'll use our knowledge of electrostatics to characterize the properties of basic circuit elements and analyze electronic circuits. In the second half of the course, we'll learn about sources of magnetic fields, magnetic forces, and electromagnetic induction. Then, we'll combine our knowledge of electricity and magnetism to investigate electromagnetic waves, which is light! In the last week of the course, we'll study various topics in optics including diffraction, reflection, refraction, and images formed by lenses and mirrors.

Materials

- Textbook: *Physics for Scientists and Engineers* by Randall D. Knight, fourth edition including the *MasteringPhysics* registration code.
- Calculator: Scientific calculator such as the **TI-30XIIS**.

Course Format

This course is organized as a flipped classroom. This means that some course content that normally would be covered during lecture is moved outside of class time. Before each class, you are expected to complete the reading assignment and watch any assigned video content. We will spend at least half of class time working on relevant problems. This will allow you to practice applying the course material and receive feedback on your problem-solving approach. Physics is all about problem solving, and *practice is essential for building your skills and knowledge.* The in-class activities will help you learn the material and will provide excellent preparation for the homework assignments and exams. In summary, come to class prepared to solve problems related to the reading assignment. We will briefly review the key concepts from the reading, solve conceptual questions as a class, review solutions to example problems, and work in groups on quantitative problems. You might even get a head start on your homework! By the end of class, you will be ready to complete the homework problems related to the material covered that day.

Course Goals

1. Explain how charges interact with electric fields and use compute the electrostatic forces on charged point particles.
2. Derive expressions for the electric field, electric potential energy, and electric potential of various charge distributions.
3. Characterize the properties of basic circuit elements including batteries, parallel-plate capacitors, resistors, and inductors.
4. Investigate how current flows through wires and analyze circuits composed of networks of capacitors or resistors.
5. Derive expressions for the magnetic field generated by moving point charges and current-carrying wires.
6. Determine the magnetic forces on current-carrying wires and analyze the motion of charged particles in the presence of magnetic fields.
7. Determine the motional electromotive force (EMF) and induced current through a conducting loop generated by a changing magnetic field.
8. Describe how Maxwell's equations are used to show that light is an electromagnetic wave and analyze the structure and properties of electromagnetic waves.
9. Analyze the interference patterns generated in single-slit, double-slit, and diffraction grating experiments using the wave model of light.
10. Analyze reflection and refraction of light and describe how mirrors and lenses form images using the ray model of light.

Grading

Your grade will be calculated according to the following distribution:

Exams	75%
Homework	15%
LC Problems	5%
Participation	5%

Exams

There will be three exams in this course, each counts for 25% of your overall grade. Exams will consist of two parts: multiple choice problems and written problems. The exams are not cumulative and instead focus on a specific subset of chapters from the textbook:

Exam 1: Chapters $22 - 25$

Exam 2: Chapters $26 - 29$

Exam 3: Chapters $30 - 31$; $33 - 34$

Homework

There will be one homework assignment per week, typically due on Sundays at 11:59pm. Note that the last homework assignment will be due on Friday 8/13 at 11:59pm. The problems will come from the textbook and will be assigned through *MasteringPhysics*. Each assignment will cover approximately two chapters worth of material and will be graded based on correctness.

LearningCatalytics (LC) Problems

During class, you will work with your peers on *MasteringPhysics* problems through the **LearningCatalytics** (LC) site. By the end of the day (11:59pm EST), you must submit your answers to these problems. *The problems will be graded on effort, not on correctness.*

Participation

This course meets *synchronously* on Mondays, Tuesdays, Wednesdays, and Thursdays. You are expected to come to class prepared and ready to work with your peers. This doesn't mean that you need to understand everything from the reading! Class time is designed for you to ask questions and practice solving problems. You don't need to get the right answers during class, just do the reading assignment and demonstrate effort during class time.

Attendance is required to earn full participation points and counts for 3% of your overall grade. Please let me know if you need to miss class due to illness, injury, power/internet outage, or other emergencies. These are excusable absences and will not negatively impact your attendance grade.

Policies

What you can expect from me:

You can expect me to teach the course content in a clear and organized manner. I will provide the information and guidance that you will need to be successful in this course. I will engage with you during the class meetings to ensure that you understand the course content and have a path forwards with whatever problem you're working on. I will also be available outside of class during office hours as well as via email to assist you. I will grade fairly and return graded assignments in a timely manner. Most importantly, I will work to make this class interesting, engaging, and fun!

What I will expect from you:

You are expected to come to class prepared! This course is organized in a *flipped classroom* format, which means that much of the course content is delivered outside of the class meetings. We will use most of class time to engage with the material by solving problems together. This format will allow you to learn from your classmates, receive guidance and feedback on your problem-solving approach, and deepen your understanding of the course material. For this format to work, you need to come to class prepared and ready to solve problems.

Academic Integrity

Do not work collaboratively unless indicated by the assignment. You may discuss the homework assignments, but do not share your solutions. If someone does show you a partial solution, do not copy it. Retain ideas and go write your own version later. **Make sure that you understand the solution that you submit.** Attribute any ideas that you use (books, online resources, etc.) and include the names of any classmates that you collaborated with. Exams must be completed independently. Equation sheets will be provided for the exams, which are closed-notes, closed-book, closed*MasteringPhysics*, and closed-internet.

Learning Community

It is important for me to create an inclusive learning environment where diversity and individual differences are respected and recognized as a source of strength. However, this must be a team effort so I expect you to join me in fostering such an environment. This class will represent a diversity of individual backgrounds and experiences, and every member is expected to show respect for every other member so that everyone can learn in this space. If you experience or witness any behavior that opposes this idea, it would be helpful for me to know so that I can address it. I recognize that this is additional work and may be difficult. If you are comfortable reporting such incidents, please email me about it.

I will use the gender pronouns and name you go by, and I expect you to use the names and pronouns your classmates go by. (I understand that some students may be in the process of exploring their gender identity, may not feel comfortable sharing a gender pronoun, or may not go by gender pronouns; you can let me know if you do not want to share a gender pronoun.)

You belong in this class! Thank you for being here and for contributing to this course!

Disability Access/Accommodation

In keeping with University policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly recommended to discuss with their faculty the accommodations they plan to use in each course. Faculty who receive Letters of Accommodation with **Disability Related Flexible accommodations** will need to fill out the Disability Related Flexibility Agreement. Any questions from faculty or students on the agreement should be directed to the SAS specialist who is indicated on the letter.

This syllabus is subject to modifications as needed.

Calendar

Date		Topic	Reading	Due Today
T	7/6	1. Charge and Coulomb's Law	22.1 – 22.4	LC 1
W	7/7	2. Electric Field of Point Charges	22.5 – 23.2	LC 2
Th	7/8	3. Electric Field of Charge Distributions	23.3 – 23.5	LC 3
Su	7/11			**HW 1**
M	7/12	4. Charge Motion in Electric Fields, Electric Flux	23.6 – 24.3	LC 4
T	7/13	5. Gauss's Law and Applications	24.4 – 24.6	LC 5
W	7/14	6. Electric Potential Energy, Electric Potential	25.1 – 25.4	LC 6
Th	7/15	7. Electric Potential Applications	25.5 – 25.7	LC 7
Su	7/18			**HW 2**
M	7/19			**Exam 1**
T	7/20	8. Electric Field and Potential	26.1 – 26.4	LC 8
W	7/21	9. Capacitance, Energy Storage of a Capacitor	26.5 – 26.7	LC 9
Th	7/22	10. Current, Resistance, Ohm's Law	27.1 – 27.5	LC 10
Su	7/25			**HW 3**
M	7/26	11. Circuit Diagrams, Series Resistors	28.1 – 28.5	LC 11
T	7/27	12. Parallel Resistors, Circuit Analysis	28.6 – 28.8	LC 12
W	7/28	13. Sources of Magnetic Fields, Ampère's Law	29.1 – 29.6	LC 13
Th	7/29	14. Magnetic Forces and Torques	29.7 – 29.10	LC 14
Su	8/1			**HW 4**
M	8/2			**Exam 2**
T	8/3	15. Induced Current, Motional EMF, Lenz's Law	30.1 – 30.4	LC 15
W	8/4	16. Faraday's Law, Induced Fields, Inductors	30.5 – 30.8	LC 16
Th	8/5	17. Maxwell's Equations, Electromagnetic Waves	31.1 – 31.7	LC 17
Su	8/8			**HW 5**
M	8/9	18. Interference, Double-Slit Diffraction	33.1 – 33.3	LC 18
T	8/10	19. Single-Slit Diffraction, Wave Model of Light	33.4 – 33.7	LC 19
W	8/11	20. Ray Model of Light, Reflection, Refraction	34.1 – 34.4	LC 20
Th	8/12	21. Lenses, Images, Mirrors	34.5 – 34.7	LC 21
F	8/13			**Exam 3, HW 6**

LC = *LearningCatalytics* Problems
HW = Homework Problems