General Physics with Calculus (PH 213, Fall 2019, 4 credits)

Instructor: Dr. Kathryn Hadley
Office: Wngr 373
Office Hours: MWF 12-1 PM or by appointment
Office Phone: 541 737 4312
Email Address: Kathryn.hadley@physics.oregonstate.edu
Course Website URL: khadley.com
Prerequisites: MTH 254 and PH 212
TA Office Hours: Wngr 334 schedule TBA
Text: *Physics for Scientists and Engineers*, 4th edition, Knight
Additional Items: Access to MasteringPhysics which comes bundled with the textbook (including an *optional* workbook) at the OSU bookstore, and a Turning Point clicker or app. The lab manual is posted on Canvas.

Baccalaureate Core Student Learning Outcomes: This course fulfills the Baccalaureate Core requirement for the **Physical Science** category:

1) Recognize and apply concepts and theories of basic physical or biological sciences;
2) Apply scientific methodology and demonstrate the ability to draw conclusions based on observation, analysis, and synthesis;
3) Demonstrate connections with other subject areas.

See the tables at the end of this document for detailed description of assessment of each outcome and the connection between the baccalaureate core student learning outcomes and the course-specific learning outcomes.

Course-Specific Learning Outcomes: By the end of this course, you will be able to:

1. Understand how to represent and analyze behavior mediated by electric and magnetic interactions;
2. Apply fundamental physics principles to analyze the behavior of physical situations under certain conditions, and to understand when to apply these laws, and how to extend these general situations to specific applications such as transformers and power transmission and complex circuits;
3. Make observations of physical behavior and find explanations that are consistent with the observations, apply these explanations and the established laws to make predictions about outcomes of experiments, and test the explanations and laws through experimentation;
4. Represent information in multiple ways (diagrams, graphs, words, equations…), and move from one representation to another, use these representations to set up problem solutions, predict the behaviors of systems, and to check the solutions to problems;
5. Use critical thinking skills as described below.
   Critical thinking is a fundamental part of science and at the heart of physics. In many ways, physics is the discipline of modeling and problem solving. In this course, you will look at new situations and make assumptions about them which allow you to make appropriate simplifications to apply physical models. Critical thinking is being able to:
   - analyze an open-ended, new physical system
   - consider what assumptions and simplifications can be made
   - breakdown the situation into manageable pieces
   - apply concepts to analyze each piece and combine them into a solution
   - evaluate if the solution makes sense

What is Physics? Physics is the study of nature. It is a *living* discipline, not a collection of facts. It is the science of daily existence. One has direct experience with the nature of forces, how things respond to those forces, the conservation of mass, energy, momentum, and some aspects of gravity. The formal study of physics should guide and clarify one's understanding to build a consistent basis of fundamentals that allows one to build models for describing the physical behavior of unfamiliar or complex systems. Physics is about reasoning, making connections, and understanding what will happen in a situation, and why it happens.

In order to do physics in a genuine sense, it is necessary to be able to apply the skills used within the discipline to new situations. When dealing with new situations, mathematical models are used to describe them. Applying these models often requires simplifications or assumptions about the physical situation. It is necessary to become proficient with the use of models, their applicability, when they are not appropriate and why, and to be able to analyze situations multiple ways. One goal is to develop a set of skills and tools that one can use to analyze any basic system, and to understand what the next step would need to be to address a more complex aspect of that system.

We will use historical experiments and scientific development, contexts from other disciplines, and modern experiments at the frontiers of our knowledge to develop the ideas in the learning outcomes and for problem solving whenever possible. The learning outcomes and critical thinking will be developed through in class demonstrations, voting questions, peer-to-peer discussions, full-class discussions, in-lecture group work and lab work. They will be *formatively* assessed through voting questions and lab work, and *summatively* assessed during exams.

What to Expect from Lecture: Lecture meets for one hour, three times per week. The purpose of lecture will be developing conceptual understanding, working on representing phenomenon, practicing problem solving, and building understanding though observations and explanations of phenomena. Lecture is interactive. There will be times in lecture that you are strongly encouraged to talk with other students near you. However, due to the large size of the class it is disruptive if you talk while the instructor is talking. Questions, comments, and interruptions are welcome, but please raise your hand.

What to Expect from Lab: The lab is the appropriate place for you to apply the tools and skills to explore more complex situations. The labs will get increasingly more open-ended, so eventually you will be able to do authentic physics modeling of real situations. Required lab write-ups will be completed during the lab period. The lab packet is posted on Canvas.

The Textbook: Most students find it helpful to read the textbook before lecture to help understand what occurs during lecture and ask productive questions. Most students also find it helpful to read the textbook after lecture to solidify what they learned during lecture. Think about the questions asked in the book as you go along and make note of what doesn't make sense to you so you can ask about it later. Most importantly, *don't fall behind* because most concepts build on those encountered earlier.

Communication: Communication will be through announcements given in lecture, posted on Canvas, and via email using oregonstate.edu accounts. You are expected to check these daily.

Exams: There will be two midterm exams (100 points each) and one final exam (150 points). The midterm exams are not held at the same time or location as the lecture. The locations will be posted on Canvas. The midterms will be given Wednesday evenings from 7:00 to 8:20 PM. The final will be given at the time and date determined by the registrar's office. All exams are closed book and comprehensive, and will include material from readings, labs, lecture, and/or homework. The exams

will consist of conceptual questions and written-out problems, including all aspects of problem solving required for homework: discussing the assumptions and concepts that apply, and evaluating the results. A formula sheet will be provided with each exam. The formula sheets will be posted on Canvas.

Bring a photo ID to each exam. **Any official exam conflict must be discussed and arrangements made with the instructor *before* the exam.** Unexcused absence will result in a zero for the exam, including the final. If you believe that an error was made in the grading of an exam question, then bring your complete exam to the instructor *within one week* after the exams have been returned. Never make any alterations or additions to the exam itself. This includes the cover page and the back of each page.

Lab: Lab meets for three hours once per week, most weeks of the term. 100 points are earned for attending and conducting all of the labs, and obtaining an *average* of at least two-thirds of the possible points for the lab reports over the course of the term. Each group will write one lab report *during* each lab. **You must pass lab in order to pass the course.** There is opportunity to make-up one or two labs during dead week Any lab scheduling issues should be addressed directly with the lab TAs.

Recitation, PH 223: Recitation is not required, but strongly recommended. It consists of weekly group problem solving sessions. Recitations are taught by experienced TAs who can address individual problems and provide guidance in small group sessions.

Formative Assessment Points: *Formative assessment is a self-reflective process that intends to promote student learning*, and as such occurs during the learning process, before graded exams. The Turning Point system will be used for formative assessment during lecture. You can earn up to 50 points for questions answered during lecture for clicker questions. You are allowed three excused absences and still earn the maximum 50 points. The three excused absences cover illness, school events, personal days and clicker malfunction. Clicker points will be uploaded to Canvas each week, so please check the gradebook to make sure your clicker is working properly. It is your responsibility to make sure the batteries are fresh. Because formative assessment is a learning tool, you will get full points for participating in all of the questions for that day *regardless of whether you choose the most correct answer.* You may only use one remote device during lecture. The use of multiple remotes is strictly forbidden.

Pre-lecture assignments: Pre-lecture assignments will be posted on Canvas 24 hours before each class, and will close one hour before class. These assignments will largely be based on assigned textbook reading. Your three lowest scores for pre-lecture assignments will be dropped.

In-class quizzes: In-class quizzes will be administered via clickers, typically at the start of class. They may not happen every class day. The questions in the in-class quizzes will typically be similar to pre-lecture questions. You will have a limited time to answer the questions, usually two minutes. Your three lowest scores for in-class quizzes will be dropped.

Homework: You will get up to 50 points for homework. Online homework will be assigned on Mastering Physics. For most assignments, two problems will also be assigned to be hand-written to check the aspects of the solutions that cannot be graded by Mastering Physics. The hand-written problems will be graded using the Required Solution format and Rubric. Half of the grade for homework will come from Mastering Physics and half from hand-written solutions. The lowest homework score will be dropped when calculating the total homework score for the online homework and also for the hand-written homework.

Grading Breakdown and Final Grades:

- Two midterms (100 points each) and the final exam (150 points)
- 100 points for lab. Students who earned prior lab credit are automatically awarded these points. Failing the lab results in failing the course. You must pass the lab in order to pass the course.
- Homework: 50 points.
- Formative Assessment (clicker questions in class): 50 points.
- Pre-lecture questions (25 points)
- In-class quizzes (25 points)
- Total: 600 points

Example. Student X earned 68% on the first midterm, 75% on the second midterm, 70% on the final, 85% of the homework points, 90% of the clicker points, 90% of the pre-lecture points, 80% of the in-class quiz points and the 100 points for passing the lab. The final grade for student X is

$$[(.68)100 + (.75)100 + (.70)200 + (.85)50 + (.90)50+ (.90)25 + (.80)25 + 100]/600 = 80\%$$

Grade Scale: The grade scale is fixed. There is no curve in this course. You are not competing against each other for a grade.

90 - 100% = A 85 - 89% = A- 82 - 84% = B+ 78 - 81% = B
75 - 77% = B- 72 - 74% = C+ 68 - 71% = C 65 - 67% = C-
62 - 64% = D+ 58 - 61% = D 55 - 57% = D- 0 - 54% = F

Email Policy and Canvas Discussion Forums: There are forums to use for out-of-class discussion on Canvas. Please post any course policy, reading, content, or homework questions on Canvas in these forums. The instructor will respond to the forums daily during weekdays so that everyone can have access to the answers, and you are encouraged to post help for each other as well. If you have a question, then it is likely to be helpful to your classmates as well. Posts from classmates addressing content issues are also welcome. You're encouraged to help each other. Use these forums instead of emailing me directly for homework help unless you have a personal question or concern that will not be appropriate or helpful for everyone.

Calculators: You will need a calculator for lecture, recitation, lab and exams. **Graphing calculators, those with a solver feature and/or graphing window, and laptop or palmtop computers may not be used for exams.** You should have a scientific calculator that has trigonometric, logarithmic and exponential functions. If you want to know whether or not your calculator is acceptable or not for exams, then consult the instructor well before the first exam.

Statement Regarding Students with Disabilities: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Student Conduct Expectations link: http://studentlife.oregonstate.edu/code

Reach Out for Success: University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).

Academic Integrity: You will be expected to conduct yourself in a professional manner. Academic dishonesty such as plagiarism and cheating will not be tolerated. Therefore, students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

* cheating - use or attempted use of unauthorized materials, information or study aids,
* fabrication - falsification or invention of any information,
* assisting - helping another commit an act of academic dishonesty,
* tampering - altering or interfering with evaluation instruments and documents, or
* plagiarism - representing the words or ideas of another person as one's own.
* using multiple ResponseCard NXT units during a single lecture period

For more information about academic integrity and the University's policies and procedures in this area, please refer to the Student Conduct web site.

Week	Date	Chapter	Sections Covered	Exam/Homework	Lab
0	W 9/25	22	22.1-5		No lab
	F 9/27	22			
1	M 9/30	22		Hw1 Tu 10/1 ch22	Electric Force
	W 10/2	23	23.1-6		
	F 10/4	23			
2	M 10/7	23		Hw2 Tu 10/8 ch23	Electric Field
	W 10/9	24	24.1-5		
	F 10/11	24			
3	M 10/14	24		Hw3 Tu 10/15 ch24	Electric Potential
	W 10/16	25	25.1-7		
	F 10/18	25			
4	M 10/21	25		Hw4 Tu 10/22 ch25	No lab
	W 10/23	Review for Midterm I	ch 22-25	Midterm I ch 22-25	
	F 10/25	26	26.1-6		
5	M 10/28	26		Hw5 Tu 10/29 ch26	DC Circuits I
	W 10/30	27	27.1-5		
	F 11/1	27			
6	M 11/4	28	28.1-9	Hw6 Tu 11/5 ch27	DC Circuits II
	W 11/6	28			
	F 11/8	28			
7	M 11/11		**No school**	Hw7 Tu 11/12 ch28	No Lab
	W 11/13	29	29.1-8		
	F 11/15	29			
8	M 11/18	29		Hw8 Tu 11/19 ch 29	Magnetic Force
	W 11/20	Review for Midterm II		Midterm II Ch 26-29	
	F 11/22	30	30.1-10		
9	M 11/25	30			Induction
	W 11/27	30			
	F 11/29		**No School**		
10	M 12/2	31	31.1-6	Hw9 Tu 12/3 ch 30	Lab Make-Up
	W 12/4	31			
	F 12/6	31			
Final	Tu 12/10	12:00 - 1:50 PM			

All dates are tentative and subject to change

CLO	Subject	Activities	Assessment
Category Learning Outcome #1	How does the course align with or meet this specific outcome?	What assignments, class activities, and discussions are used to address this outcome?	How is student achievement of this outcome formally measured?
Recognize and apply concepts and theories of basic physical or biological sciences.	Apply fundamental physical principles in the mathematical analysis of systems. Differentiate between quantitative problem solving and qualitative logical reasoning methods to analyze physical systems. Use critical thinking to apply appropriate physics frameworks to model systems. Use multiple representations, such as mathematical, physical, graphical, verbal, and experimental, along with sense-making strategies to analyze physical systems. Apply the theories of electric forces, electric fields, electric potentials, circuits, magnetic forces, magnetic fields, electromagnetic induction, and electromagnetic waves to answer questions about the physical universe.	Students write solutions to questions about physical systems using multiple representations in lecture, homework, and lab. Specifically, formative assessment is provided in a progression of pre- and post-lecture work informed by active peer learning during lecture time. Students are challenged to synthesize their knowledge in hand-written homework sets. Additionally, students explore physical phenomena during lab experiments.	Student achievement of this outcome is measured in formative assessment using homework and lab reports. The majority of summative assessment is provided by written responses to exam questions that ask students to answers questions about the physical world. Grades are determined by students ability to demonstrate mastery of the learning outcomes during all formative and summative assessments.

CLO	Subject	Activities	Assessment
Category Learning Outcome #2	How does the course align with or meet this specific outcome?	What assignments, class activities, discussions are used to address this outcome?	How is student achievement of this outcome formally measured?
Apply scientific methodology and demonstrate the ability to draw conclusions based on observation, analysis, and synthesis.	Identify the important mechanisms in the system, connecting theory to experiment. Set up experiments to measure physical quantities and record data to test a hypothesis. Develop skills to analyze experimental results with a multitude of techniques including fitting data with appropriate mathematical formulae, quantifying uncertainty, comparing empirical results with theory, and evaluation of the success of the hypothesis. Apply the theories of electric forces, electric fields, electric potentials, circuits, magnetic forces, magnetic fields, electromagnetic induction, and electromagnetic waves to experimentally analyze physical phenomena.	Students will use and build scientific skills through a combination of prescribed, discovery, and inquiry-based lab activities. The work is performed within a lab group. Group lab reports are created that document the hypothesis, design, data collection, and results of the experiment. Guiding questions are posed and students write explanations through a combination of hypothesis, test, and conclusion. Experiments include a study of electric force, electric field, electric potential, DC circuits, magnetic force, magnetic field, and electromagnetic induction.	Student achievement of this outcome are measured through evaluation of lab reports. Specifically how complete, clear, and correct writings and analysis convey mastery of the physical phenomena explored. Complete synthesis from theory to observation to conclusion to reflection must be presented in their work. Grades are assigned based on the quality of the work presented in their lab reports.

CLO	Subject	Activities	Assessment
Category Learning Outcome #3	How does the course align with or meet this specific outcome?	What assignments, class activities, discussions are used to address this outcome?	How is student achievement of this outcome formally measured?
Demonstrate connections with other subject areas.	Students solve problems where the framework is based in physics but the context is a diverse set of engineering disciplines. Specifically, the distribution of context types is intended to match the distribution of majors in the course. Mechanical, electrical, civil, structural, biological, and computer engineering applications are found throughout the curriculum. Students solve problems using a diverse set of mathematical disciplines. Algebra, geometry, trigonometry, and calculus are all required in order to solve complex problems. Examples include: resistive circuits, capacitive circuits, RC circuits, mass spectrometers, alternators, generators, transformers, inductive circuits, LC circuits, and RL circuits.	Students write solutions to questions about physical systems from a wide variety of scientific fields using multiple representations in lecture, homework, and labs.	Student achievement of this outcome is measured in formative assessment using homework and lab reports. The majority of summative assessment is provided by written responses to exam questions that ask students to answers questions about the physical world. Grades are determined by students ability to demonstrate mastery of the learning outcomes during all formative and summative assessments.