General Physics with Calculus (PH 212, Spring 2019, 4 credits)

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Prerequisites: MTH 252 and PH 211

Corequisite: MTH 254

Text: *Physics for Scientists and Engineers*, 4th edition, Knight

Additional Items: Access to MasteringPhysics which comes bundled with the textbook (including an *optional* workbook for no cost) at the OSU bookstore, and a ResponseCard NXT hand-held communication device (clicker). The lab manual is posted on Canvas.

This course is part of the **OSU Baccalaureate Core** and fulfills the requirement for study related to **Physical Science**. The **Baccalaureate Core Student Learning Outcomes** for this category are: 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, and 3) demonstrate connections with other subject areas.

What is Physics? Physics is more than a collection of facts and formulas, it is a dynamic discipline that encompasses everything in nature. Phenomena that we experience in everyday life can be understood in terms of underlying frameworks derived from simple principles. Exotic and complex systems also must obey the same set of laws of physics as systems that are encountered every day.

The study of physics involves metacognition, thinking about how you think. While learning physics, keep reflecting on how you are learning. Focus on conceptual understanding as you learn to analyze simple systems, and extend into more complicated systems. Physics involves reasoning, making connections between the physical situation, graphic representations, and mathematics. During every step of the process, reflect back to the physical situation to consider what will happen and why. Be ready to apply what you have learned to new situations, extrapolating beyond the models you have developed for similar situations. Learn to recognize what kinds of tools or techniques are useful for any given physical situation.

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

- understand how to represent and analyze motion for solids, oscillations and waves
- 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 how microscopes work.
- make observations of physical behavior and find explanations that are consistent with the observations; apply the explanations and the established laws to make predictions about experimental outcomes, and test the explanations and laws through experimentation
- represent information in multiple ways (diagrams, graphs, words, equations. etc.), 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
- use critical thinking skills within physics problem solving 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 learn to look at new situations and make assumptions about the situations that allow you to make appropriate simplifications to apply physical models. Critical thinking in this class is being able to:

- analyze an open-ended, new physical situation
- consider what assumptions and simplifications can be made to this situation
- break down the situation into manageable pieces
- apply the concepts learned to solve these pieces and put them together for a solution
- evaluate if the solution makes sense

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. Pre-printed notes won't be available because the notes will be unique to what happened each day.

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 onid accounts. You are expected to check these daily.

Exams: There will be two midterm exams (100 points each) and one final exam (200 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 held Wednesday evenings from 7:00 to 8:20 PM. The final will be held on the day and time listed at the end of this document. 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 two weeks* 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. Your final exam will not be returned, but you are welcome to review it during the first week of the following term.

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 222: 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.

Honors Recitation, PH 222H: This course is an opportunity for honors college students to have more in-depth discussions with a senior faculty member about the PH 212 topics.

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 ResponseCard NXT system (Turning Point clickers) will be used for formative assessment during lecture. One can earn up to 50 points for questions answered during lecture. Answering all the questions during a lecture earns 1 point for that day. The total points for the term will be scaled to be worth 50 points. Three absences will be allowed with no loss in points. Because formative assessment is a learning tool, you will get full points for participating in all the questions for that day *regardless of whether you choose the most correct answer.* You can only use one ResponseCard NXT remote during lecture, use of multiple remotes is not allowed.

Pre-lecture assignments: Pre-lecture assignments will be posted in Canvas and will be worth up to 50 points. The questions may be multiple choice, multiple answer, calculation, or short answer questions and will be based on concepts to be covered in the following lecture. The pre-lecture assignments will be due one hour before lecture and will be available for no less than 24 hours before lecture. Total points for the term will be scaled to be worth 50 points.

Homework: You will get up to 50 points for homework. Homework will be assigned on MasteringPhysics. For each assignment, a subset of the problems will be collected at the beginning of lecture to check the aspects of the solutions that cannot be graded by MasteringPhysics. It is therefore imperative that you bring written homework solutions to lecture the day it is due with *your name clearly printed at the top right-hand corner.* Half of the grade for each homework assignment will come from MasteringPhysics and half from hand-written solutions. The lowest homework grade will be dropped when calculating the total homework score, and each assignment will carry the same weight. If you believe that an error was made in the grading of a homework question, bring your complete homework to the instructor *within two weeks* after it was returned. Never make any alterations or additions to the homework itself.

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: 50 points
- Pre-lecture assignments: 50 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, 95% of the formative assessment points, 90% of the pre-lecture points, and the 100 points for passing the lab. The final grade for student X is

$$[(.68)100 + (.75)100 + (.70)150 + (.85)50 + (.95)50 + (.90)50 + 100]/600 = 81\%$$

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

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, studio, 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.

TA Office Hours: The TAs will hold hours in Wngr 334 (The Wormhole) afternoons from 12:00 to 6:00 and in the Valley Library evenings from 6:00 to 10:00. A schedule will be posted outside Wngr 334. TA office hours start the second week of the term. There is also free tutoring available for anyone through the Women and Minorities in Engineering Program.

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.

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 and the section on Academic Regulations in the OSU Schedule of Classes.

Week	Date	Chapter	Sections Covered	Exam/Homework	Lab
1	M 4/1	4	04.4-6		
	W 4/3	4			Lab 0: Uncertainty Analysis
	F 4/5	8	08.1-5		
2	M 4/8	8			
	W 4/10	8	12.1-11	Hw 1 due (Ch4)	Lab 1: Rotational Motion
	F 4/12	12			
3	M 4/15	12			
	W 4/17	12		Hw 2 due (Ch8)	Lab 2: Rotational Dynamics
	F 4/19	15	15.1-8		
4	M 4/22	Midterm I review	Ch 4, 8, 12		
	W 4/24	15		Hw3 due (Ch 12) Mid I Ch 4, 8, 12	Lab 3: Oscillations
	F 4/26	15			
5	M 4/29	16	16.1-9		
	W 5/1	16		Hw 4 due (Ch 15)	No Lab
	F 5/3	16			
6	M 5/6	17	17.1-8		
	W 5/8	17		Hw5 due (Ch 16)	Lab 4: Standing Waves
	F 5/10	17			
7	M 5/13	33	33.1-4		
	W 5/15	33		Hw 6 due (Ch 17)	Lab 5: Interference
	F 5/17	33			
8	M 5/20	Midterm II review	Ch 15, 16, 17, 33		
	W 5/22	34	34.1-7	Hw 7 due (Ch 33) Mid II Ch 15, 16, 17, 33	Lab 6: Refraction
	F 5/24	34			
9	M 5/27			No School Memorial Day	
	W 5/29	13	13.1-6	Hw 8 due (Ch 34)	No Lab
	F 5/31	13			
10	M 6/3	13			
	W 6/5	13		Hw 9 due (Ch 13)	Lab Make-Up
	F 6/7	Final review	All Chapters		
FINAL	F 6/14	7:30 AM			