Physics 121 Fall 2020: Syllabus

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Welcome to Physics 121!

This is the first semester of a calculus-based introductory physics course that focuses on kinematics, dynamics, simple harmonic motion, gravity, fluids & elasticity, and (sometimes) thermodynamics. In this course, we will use calculus freely and frequently, so (ideally) you should have taken, or (less ideally) should be concurrently enrolled in, calculus. Lectures in this course will assume that you have read the text and will focus on concepts, problem solving and the clarification of important concepts in the text.

I am looking forward to helping you learn about the physical laws that describe how our universe works and also to develop habits of mind that will be useful in your life and future carreer. In addition, I hope to build your problem solving skills, your quantitative reasoning abilities, and to provide a knowledge base which will be useful no matter what your major may be. I will try to do whatever I can to show you the beauty of physics and to help you broaden your appreciation of the natural world by helping you understand not *why* it is as it is, but *how* it works.

I take teaching very seriously, and I will work hard to help you learn.

This document

Should you lose this syllabus, an electronic .pdf version of this file (with clickable hyperlinks) is available online at the course homepage which can be found at http://portlandphysics.me/phy121.

Instructor

Paul Nakroshis
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Office hours: Tue: 10:15 - 11:00,
Wed 1:00-2:00 pm,
and by appointment.

Outside Help/Office Hours

In general, if my office door is open and I have time, I am happy to help you, so feel free to stop in and ask questions. My dedicated office hours are listed up above; if you cannot make this time, please talk with me and we'll make a time to meet.

Electronics use during class: Unless you are a genius at speed–typesetting of equations on a computer, I see no reason to use a laptop to take notes in class. I recommend that you put your computer away and take notes with pen and paper (see this link if you need some evidence!). In any case, using a computer, cellphone, or tablet to check Instagram, tiktok, Facebook, Twitter, or to play games during class takes away from your ability to learn and distracts those sitting near you. Please refrain from using electronics during class.

Attendance/Participation/Missed Exam Policy

I expect that all of you will attend class and actively participate. I try to make a class a valuable learning space, so it's to your advantage to attend.

Textbook:

We will be using the open source textbook *University Physics, Vol. 1, by OpenStax,* which you can find at

https://openstax.org/details/books/university-physics-volume-1.

This text is free and includes an online version, a downloadable pdf, and even an iPad version. You can also purchase a print version, if you prefer, via the campus bookstore or from OpenStax on Amazon.com.

You can use whichever formats you want. If you buy on Amazon, make sure you use the link on your book page on openstax.org so you get the official OpenStax print version. (Simple printouts sold by third parties on Amazon are not verifiable and not as high-quality.)

University Physics Volume 1 from OpenStax, Print ISBN 1938168275, Digital ISBN 1947172204

Academic Integrity

I expect that everyone will be academically honest and that your work on exams will be the sole product of your thinking without the use of search engines, or assistance from others. I prefer to conduct class by placing this trust in you.

Students with disabilities

At any point in the semester, if you encounter difficulty with the course or feel that you could be performing at a higher level, consult with me. Students experience difficulty in courses for a variety of reasons. The following resources are available on campus for students:

- For general physics questions or time management, you can make an appointment to see a student tutor at the Learning Commons located in both the Portland and Gorham libraries. For more information, visit http://www.usm.maine.edu/learningcommons.
- If you need accommodations due to a disability, please contact the Disability Services Center for confidential assistance and accommodation authorization. Timely notification of accommodations is essential. For more information, visit, http://usm.maine.edu/dsc University Health and Counseling Services is a student resource that promotes the health and well-being of the USM community. More information can be found at www.usm.maine.edu/uhcs.
- In these times of covid-19, if you have any health issues (autoimmune disease, diabetes, etc), you are encouraged to not place yourself at risk, and you may engage with this class completely online. If this is the case, please let me know so that I do not get concerned when I do not see you in class.

Expectations:

What you can expect from me:

1. I will work hard to make class both interesting and useful to you (but I cannot do the work of learning for you!)
2. I will be open to feedback and constructive criticism about my teaching.
3. I will be available for assistance outside of the classroom and I look forward to meeting you.
4. I will be on time to class, and I will end class on time.
5. I will respond promptly to your emails received before 4pm. Emails after that time will be responded to on the next weekday.
6. If you have an *emergency* and need to contact me, you may **call** me at my cell phone: 207.449.7531
7. I will do my best to make sure examinations are fair and challenging.

8. I will grade and return examinations in a timely manner.

What I expect of you:

1. You have read this syllabus, understand the required workload, and meet the calculus co/pre-requisite.
2. You will be an active, engaged participant in class and class discussions, and are coming to class to learn, not just to satisfy a requirement.
3. You understand that you must accept responsibility for your own learning and take an active role in the learning process.
4. You will watch lectures, read and work through the relevant sections in the text **before** they are discussed in class. (Reading a physics textbook is an activity that involves taking notes and thinking and working through problems and examples with paper and pencil; it's not like sitting down to read a good novel.)
5. You will come to office hours and tutoring sessions if you need help; you will not wait until you are too far behind to do so.
6. You will construct a working *content* knowledge of the physics topics we discuss in class.
7. You will also have another goal to understand deeply the *underlying concepts* and be able to apply them to systems you have never seen before.
8. You should expect to spend 8-12 hours per week outside lecture on this course.

Assessment

Your grade in this course will be based on my subjective opinion of your level of understanding of the physics topics we discuss in this course. Your best way of being successful in achieving a good grade is to study the lectures and text and work to *understand* as many homework problems as possible so that you score well on the 4 quizzes, the 3 exams and the final. Put these dates on your calendar-if you have another class with exams on the same date, please prepare accordingly.

Quizzes & Exams

Exams will include both *conceptual questions* and *quantitative reasoning questions* where you will have to solve problems through the use of legible figures, proper English explanations that appeal to relevant

physical concepts and laws, and valid mathematical reasoning. Exams will be done via Brightspace and will be multiple choice, and time limited, but I will provide (below) a list of earliest and latest starting times. Look at your calendar and allocate 1 hour for quizzes and two hours for exams. For example, for quiz # 1, the time range is 10:00 to 21:00; that means that you may start at 10:00 am if you like, or any time between 10:00 and 21:00 at the latest. Once you start, you have 1 hour (for quizzes) and 2 hours (for exams) to complete and submit your work.

- **I will drop your lowest of the three exam grades (not the final exam) and replace it with the average of all three of your exams.** This does not entirely negate a poor exam score, but it does help significantly; so you should try your best on each exam.
- I will do the same with your 4 quizzes; I will replace the lowest with the average of all 4 quizzes.
- Exams and quizzes must be your individual work with no internet or human help other than asking me clarifying questions.
- The questions on the exams are a combination of quantitative problems and conceptual questions resembling the discussion questions and worksheets used in class.
- You may use the textbook and your notes for the exam. This means you may use the online version of the textbook.
- The examinations cover all the material in the text that has been assigned as reading (even if the subject was never discussed in class).

Here are the exam dates for the semester and the point values for each item; notice I give a range of start times, but the FINAL EXAM time is fixed by the university, and must be taken in the allotted slot.

Quiz # 1	Friday 11 Sep 2020 (10:00 to 21:00)	50 pts
Exam # 1	Wednesday, 23 Sep 2020 (10:00 to 21:00)	200 pts
Quiz # 2	Friday 2 Oct 2020 (10:00 to 21:00)	50 pts
Exam # 2	Friday 16 Oct 2020 (10:00 to 21:00)	200 pts
Quiz # 3	Friday 30 Oct 2020 (10:00 to 21:00)	50 pts
Exam # 3	Friday, 13 Nov 2020 (10:00 to 21:00)	200 pts
Quiz # 4	Friday, 4 Dec 2020 (10:00 to 21:00)	50 pts
Final Exam	Thursday 17 Dec 2020 8-10 am	200 pts
	TOTAL Points:	**1000 pts**

Grading Scale

The table below shows the grading scale for the final semester grade.

Letter Grade	Numerical Percentage
A	93.0 -100
A-	90.0 - 92.9
B+	87.0 - 89.9
B	83.0 - 86.9
B-	80.0 - 82.9
C+	77.0 -79.9
C	73.0 - 76.9
C-	70.0 - 72.9
D+	67-69.9
D	63-66.9
D-	60.0 - 62.9
F	0 - 59.9

Homework

Succeeding in physics entails struggling with and solving physics problems so that you build a clear and deep understanding of the laws that describe how nature works. You need to build a conceptual understanding of the principles, as well as a technical facility with the mathematics needed to solve the problems. I strongly urge you to keep a dedicated notebook in which you *neatly work out your homework problems* and include:

- A statement or at least a brief statement of the original question.
- A logical handwritten solution of the question, with your reasoning clearly laid out in both prose and equations.
- A figure to help explain the problem and solution will *almost* always be a component of a good solution.
- A clearly visually indicated final numerical solution value when appropriate.

I also encourage you to work together in groups on homework. Although I will not collect your homework notebooks, I can say from decades of experience that with few exceptions, there is an outstandingly good positive correlation between the quality and quantity of effort put into homework and the final course grade. If you do not put forth a serious effort into your homework, you will likely NOT do well in this class. You have to do the mental work of building up a

model of how nature works, I can help with this, but the heavy lifting is your responsibility. The good news is that there is not a lot of memorization in physics, but there is a good deal of depth and subtlety in nature, so you'll never be bored studying physics.

Homework Assignments

The homework problems for the entire semester are listed at the end of this syllabus; they come from the the OpenStax University Physics Vol. 1 (and some from vol. 2) text, and are available on Brightspace. You need to schedule time every day to work these problems; some of them are quite challenging!

Advice

Learning any new subject involves learning to struggle with the inevitable confusion that accompanies the learning process. You may try to get around this by trying to memorize formulas, but this does not really constitute real learning. You have to spend the time to build a mental picture of how the concepts and varied principles that we study fit together, and I will try to help with this task in lecture by (a) showing you how I think about physics, and (b) by asking you questions to elicit a state of confusion. Then, with peer discussions and my guidance, I hope to help you get over your sense of confusion.

Reading the textbook and solving homework problems will constitute your work outside of class. In writing solutions to homework problems, you will also struggle with confusion how to interpret the problem, figuring out any assumptions that you must make, and coming up with a method to reach a viable answer –all of these steps may prove challenging. My recommendation to you is to work together outside of class–perhaps a dormitory-based study group, or form your own group and work in room 250 or on the boards outside of room 250 Science.

You will notice that almost all the homework problems assigned are odd numbered and therefore many have answers that you can look up However, you will be doing yourself a *massive* disservice if you leap to the solutions manual if your first attempt at a solution fails. You may go down a wrong path in solving a problem, but sometimes you need to do this to find the correct way to solve a problem.

However, after a good first, second, and maybe third attempt, if you are still confused, please seek help from me, or from the Learning Commons.

Strategies to avoid:

- Giving up on a problem, finding instructor solutions, glancing at the solution, saying "oh, I get it" and then repeating this procedure with other homework problems. You are fooling yourself to think you can learn physics in this way. You absolutely need to struggle with the problems and make errors and come to see me or our LA's to talk about the underlying conceptual issues.
- Memorization-the exams and quizzes are open book, open notes.
- Cramming to catch up just before the examinations-it will be **impossible** to assimilate all the material.
- Compulsively solving countless problems in hopes of learning by example can work, but can be very time-consuming and prevents you from putting the effort into understanding the underlying concepts.
- Waiting too long to ask for help–I cannot emphasize enough how important it is to make a serious first attempt at a problem on your own; but having done that, if you are still confused, please seek help immediately. All too often students wait too long to ask for help, and meanwhile we have progressed several chapters beyond where their confusion began.

TITLE IX

The University of Southern Maine is committed to making our campuses safer places for students. Because of this commitment, and our federal obligations, faculty and other employees are considered mandated reporters when it comes to experiences of interpersonal violence (sexual assault, sexual harassment, dating or domestic violence, and stalking). This means that **if you tell me about any incident of interpersonal violence, I must notify the University's Deputy Title IX Coordinator** who can help provide support and academic remedies for students who have been impacted.
For more information, please see the resources below:

- Information on the Campus Safety Project: http://usm.maine.edu/campus-safety-project or by contacting Sarah Holmes, USM's Title IX Coordinator: sarah.e.holmes1@maine.edu or 207-780-5767.

Confidential Contacts:

- University Counseling Services (207-780-4050)
- 24 Hour Sexual Assault Hotline (1-800-871-7741)
- 24 Hour Domestic Violence Hotline (1-866-834-4357).

- National suicide hotline is 1-800-273-8255 and the text line is 741741.

Final Words

Nothing worth knowing or achieving comes without effort. This course will likely be a lot of effort for many of you, but remember that pushing and challenging yourself is a good thing. Throughout all of this effort, I want to communicate to you the wonder and beauty that exists in the world, and that there is beauty in understanding that many phenomena can be understood via a very few physical concepts. Richard Feynman says it best:

> "I have a friend who's an artist and has sometimes taken a view which I don't agree with very well. He'll hold up a flower and say "look how beautiful it is," and I'll agree. Then he says
>
> > "I as an artist can see how beautiful this is but you as a scientist take this all apart and it becomes a dull thing,"
>
> and I think that he's kind of nutty. First of all, the beauty that he sees is available to other people and to me too, I believe. Although I may not be quite as refined aesthetically as he is ... I can appreciate the beauty of a flower. At the same time, I see much more about the flower than he sees. I could imagine the cells in there, the complicated actions inside, which also have a beauty. I mean it's not just beauty at this dimension, at one centimeter; there's also beauty at smaller dimensions, the inner structure, also the processes. The fact that the colors in the flower evolved in order to attract insects to pollinate it is interesting; it means that insects can see the color. It adds a question: does this aesthetic sense also exist in the lower forms? Why is it aesthetic? All kinds of interesting questions which the science knowledge only adds to the excitement, the mystery and the awe of a flower. It only adds. I don't understand how it subtracts"

Chapter	Problems
Week 1	
1	17, 31, 37, 57, 80, 87
3	5, 11, 12, 19, 27, 31, 32, 43, 45, 47, 49, 72, 89, 101
2	5, 13, 14, 28, 36, 37, 43, 49, 64, 67, 86
Week 2	
4	1, 5, 15, 19, 31, 33, 36, 37, 45, 48, 97
4	61, 63, 67, 73, 83, 87
various	Ch. 2: 91, Ch. 3: 111, Ch4: 101 (review for Quiz 1)
Week 3	
5	2, 5, 7, 11, 19, 29, 31, 37
5	41, 45, 63, 67, 71
6	17, 25, 39, 43, 45, 53, 63, 73, 95, 109, 126
Week 4	
Review for Exam 1	
15	1, 3, 21, 22, 29, 43, 60, 61, 73
7	3, 23, 28, 37, 44, 49, 54, 55, 56, 64, 69, 93
8	25, 26, 31, 42, 68, 71, 74, 75
13	13, 18, 21
Week 5	
6	79, 84, 87, 134
15	57, 60, 69
Review for Quiz 2	
Week 6	
13	13, 18, 21, 29, 33, 34
9	1, 20, 25, 27, 31, 33, 35, 37
9	43, 46, 47, 62, 63, 72, 75
Week 7	
9	73, 77, 78,79, 97
Review for Exam 2	
Review for Exam 2	
Week 8	
10	28, 29, 32, 37, 39, 43, 47, 55, 61, 63
11	19, 21, 23, 26, 34, 39, 49, 52*, 56, 58
10	65, 66, 69,71, 77, 79, 81, 93, 101 and
11	6, 11, 86, 97
Week 9	
10	121, 123, 125
13	47, 49, 51
12	15, 25, 26, 27, 33, 38, 75
Week 10	
12	47, 53, 59, 68
10	115; also: compute the period of small oscillations for this pendulum.
14	4, 9, 11, 18, 55, 61, 65, 73

Chapter	Problems
Week 11	
14	23, 25, 81, 89
Review problems for Exam 3 (TBA)	
Week 12	
TBA	
Week 13	
Thanksgiving Break	
Week 14	
TBA	
Week 15	
TBA	