PHYSICS 0174: Basic Physics for Science and Engineering I

Spring 2021

Lecture: PittFlex remote lectures, with synchronous sessions most Tuesdays and Thursdays 1:15PM-3:00PM

Recitation: Remote sessions, as scheduled, with TA

Contact Information:

Instructor: Dr. Melanie L. Good
Virtual Office Hours: Mondays 12:00PM-1:00PM Thursdays 3:00 PM-4:00PM
Email: mlgood@pitt.edu
PLEASE USE "Phys0174" in the subject of all email correspondence!

Corequisites: CREQ: MATH 0220 or 0235

Textbook:

- **Required:** *Fundamentals of Physics* by Halliday, Resnick, and Walker, 11th edition, ISBN 9781119455608
- **Suggested:** *University Physics, Volume 1* by OpenStax
  `https://openstax.org/details/books/university-physics-volume-1`

Course Description: This is the first part of a two-term sequence that introduces students to the basic principles of physics. An effort has been made to achieve a better integration of physics with the first term of calculus, engineering, and chemistry. The course covers mechanics and waves. Students planning to major in physics are urged to take the equivalent honors course (Physics 0475).

Honor Code:

Students are expected to uphold the University's standard of conduct relating to academic honesty. Students assume full responsibility for the content and integrity of the academic work they submit.

Students shall be guilty of violating the honor code if they:

1. represent the work of others as their own
2. use or obtain unauthorized assistance in any academic work
3. give unauthorized assistance to other students
4. modify, without instructor approval, an examination, paper, record, or report for the purpose of obtaining additional credit
5. misrepresent the content of submitted work

Any student violating the honor code is subject to receive a failing grade for the course and will be reported to the Vice President of Academic Affairs.

Additional Academic Integrity Information for Online Classes:

Online classes may appear to allow freer access to information from sources offering "tutoring" services or other help to students, but please be aware that the University Honor Code is expected to be upheld to the same degree for online classes as for in-person classes. Students who utilize online tutoring services, solutions manuals, videos, or other online resources to represent their own work are in violation of the above

Honor Code, and will be subject to the same consequences as any academic integrity violation which would occur during an in-person class. Likewise, communication with others through text message, social media, GroupMe, etc. is not permitted during online quizzes, tests, or exams, and any information relevant to quizzes, tests, or exams which is shared among students in any form is considered a violation of academic integrity. Academic integrity is taken very seriously by the University and every effort will be made to ensure that all students enrolled in online courses are upholding the expectations of the University Honor Code.

(Special Note from Instructor: During the COVID-19 remote instruction in the Spring of 2020 and Fall of 2020, students cheating on online physics quizzes, exams, and projects were caught and received consequences described above and I will not hesitate to pursue any future cases of academic dishonesty; I have a zero tolerance policy for academic integrity violations. Please avoid infractions and assume that all online graded activities may be recorded and/or will be scrutinized for academic honesty.)

Course Objectives:

The department has clearly-defined Learning Objectives for the course, listed at the end of the syllabus, and also available online: `https://www.physicsandastronomy.pitt.edu/sites/default/files/PHYS_0175_Learning_Objectives_2017.pdf` :

Course Structure: Synchronous sessions will take place every Thursday and every-other Tuesday, but these sessions will not be a typical lecture-style class. Instead, the lecture material can be found on my YouTube playlist. This course will be conducted in a "flipped" format, which means you are expected to view the video lectures on YouTube whenever is convenient for you (assuming you keep up with the content). You should take care to stick to the schedule below, because I will be conducting each class under the assumption that you have already seen the relevant video lectures for that Unit. Also, remember that just because you are watching a YouTube video, doesn't mean you shouldn't take notes! Taking good notes is an important skill. Your notes should include things such as what the correct answers to any lecture questions are, and solutions to any example problems. [Note that if you find an error in a YouTube video, please leave a comment–it may earn you extra credit!]. During synchronous sessions, I will either be running you through worked examples of content from the Unit listed in the schedule below (again, I'll be assuming you've already seen the YouTube videos tor those Units), or I will open the class up to q&a about anything relevant you wish to discuss–homework problems, recitation problems, upcoming exams, content from the textbook, or general conceptual questions, etc. I anticipate that q&a classes will center around the Units listed in the schedule in the syllabus; please take advantage and have questions ready for these sessions! As an added benefit to a typical class, because we are using zoom, classes are always recorded and Panopto recordings of the synchronous sessions provide you an opportunity to re-watch anything you may have missed. Whenever you see "asynchronous" on the schedule below, there is no live, synchronous session that day. Instead, you are encouraged (but not required) to meet in study groups. I've also built asynchronous time into the schedule to allow for the possibility that some students may prefer to work independently and/or to catch up on viewing class recordings or YouTube video lectures. If you choose to meet in a study group, you can meet via Zoom, GroupMe, or in whatever way you prefer. You are encouraged to discuss the material that was discussed in lecture, homework problems, or anything else that seems sensible–ie., you can use this time in whatever manner you deem most helpful to you.

Course Topics:

- Unit 1: Motion in One and Two Dimensions [Video Lectures L1 through L5 (up to 10:15)]
- Unit 2: Force and Motion [Video Lectures L5 (10:15 to end) through L10 (up to 7:00)]
- Unit 3: Energy and Work [Video Lectures L10 (7:00 to end) through L13]
- Unit 4: Linear Momentum [Video Lectures L14 through L17]
- Unit 5: Rotational Kinematics [Video Lectures 18 through L21 (up to 12:00)]
- Unit 6: Torque and Angular Momentum [Video Lectures L21 (12:00 to end) through L24]
- Unit 7: Equilibrium and Elasticity [Video Lectures L25 through L26 (up to 14:15)]
- Unit 8: Gravitation [Video Lectures L26 (14:15 to end) through L29]
- Unit 9: Oscillations [Video Lectures L30 through L33 (up to 2:40)]
- Unit 10: Waves [Video Lectures L33 (2:40 to end) through L35]

Tentative Schedule:

Wk	**Tues**	**Thurs**
1	Jan 19 (Introduction and Unit 1)	21 (Unit 1–problem-solving)
2	26 (Unit 1 & 2–asynchronous)	28 (Unit 2–problem-solving)
3	Feb 2 (Unit 2–q&a)	4 (Unit 2–problem-solving)
4	9 (Unit 3–asynchronous)	11 (Unit 3–problem-solving)
5	16 (Review for Midterm 1)	**18 (Midterm 1)**
6	23 (Unit 3 & 4–asynchronous)	25 (Unit 4–problem-solving)
7	Mar 2 (Unit 4–q&a)	4 (Unit 4–problem-solving)
8	9 (Unit 5–asynchronous)	11 (Unit 5–q&a and problem-solving)
9	16 (Unit 6–q&a)	18 (Unit 6–problem-solving)
10	23 (Unit 7–asynchronous)	25 (Unit 7–problem-solving)
11	30 (Review for Midterm 2)	**Apr 1 (Midterm 2)**
12	6 (Unit 8–asynchronous)	8 (Unit 8–q&a and problem-solving)
13	13 (Unit 9–q&a)	15 (Unit 9–problem-solving)
14	20 (Unit 10–asynchronous)	22 (Unit 10–q&a and review for final)
15	Finals week	Date/time of Final TBA by the University

Grading Scheme:

- 10% Participation
- 5% Homework
- 30% Midterms (Two worth 15%/each)
- 15% Recitation Work
- 10% Capstone Project
- 30% Final Exam

See below for description of each grading component.

Particpation (worth 10% of grade): To reflect that different students may have different technology and scheduling constraints, participation will be somewhat flexible. Students must participate 10 times, and can choose how to participate among the following available activities, in any combination students choose: 1. During synchronous lecture sessions, ask a question in the chat. 2. During recitation sessions, ask a question verbally or in the chat. 3. Contribute a genuine response or question in the discussion board post created by your instructor on Canvas. Note that it is important that, during lectures, you type the question into the chat; since there are so many students, this will allow a written record of your participation and will minimize verbal interruptions. Of course, you may ask the question verbally, especially at logical pauses when verbal questions are encouraged, but please also type the question in the chat. If you do not want to direct your question to the entire class, it can be directed to the instructor or TA privately in the chat options.

Homework (worth 5% of grade): Homework assignments will be integrated into Canvas, including some multiple choice questions, some open-ended questions, and some questions in which you will need to upload images of your textbook problem solutions. Assignments are graded mostly on completion, with 1-2 questions per assignment graded on accuracy. Which questions are graded on accuracy will not be announced in advance. Additional optional assignments for those wishing for extra practice will be included through the free online system called Lon-Capa, which will be linked from the Courseweb home page.

Midterms (Two worth 15%/each for a total of 30% of grade): Midterm exams will take place on the dates above during synchronous class zoom sessions. Although normal synchronous class sessions do not require students to turn their cameras on, **cameras are required to be on during exams, and must show the student and the desk/surface on which they are working.** For privacy's sake, you are permitted to use a false background and keep your audio off. However, to ensure academic integrity during exams, video monitoring will take place, and sessions will be recorded. Students should expect these recordings will be reviewed by the instructor after the exam. You should test your device's capability to keep your camera on and include yourself and your workspace, and ensure that you are in a location with good connectivity, **in advance** of the exam. This is your responsibility; preventable technical failures may risk forfeiture of your exam. During each exam, students will log into Canvas, and begin taking the exam that will appear when the class time begins, and the exam will be timed. Students may use a calculator, scratch paper, and an equation sheet of their own making. After the exam, you will be asked to submit photos of your scratch paper and equation sheet. Students who cannot resolve conflicts to take the exams synchronously will be required to take a different version of the exam at an alternate time and/or may be required to take exams as make-up exams through the testing center in the Cathedral of Learning if an alternate time cannot be arranged.

Recitation work (worth 15% of grade): As part of the recitation activities, students will be working with the TA on problem-solving activities. **You are strongly encouraged to work in groups on these problems**. Although you may work with each other freely, each person must submit their own individual recitation work on Canvas.

Capstone project (worth 10% of grade): During finals week, you will submit a capstone project and participate in the peer-review process. The capstone project will consist of a short final paper which will summarize a simple experiment students can conduct at home. As part of your grade, you will also be required to submit a peer-review of three other students' papers. Your paper's grade will be partly determined by the peer reviews, but the final determination will be up to the instructor and/or TA.

Final Exam (worth 30% of grade): The final exam will be comprehensive and will take place during finals week and will be conducted in a similar manner to the midterm exams; however, alternate final exam times will not be allowed, so any conflict with the final exam, as scheduled by the University, must be brought to the attention of the instructor immediately.

Code of Conduct:

Communication is key to a productive learning environment, and we can maintain productive communication by exhibiting respect for one another. The success of the course for yourself and others depends on all of our commitment to behavior that demonstrates respect for differences, understanding towards others and a willingness to listen and learn. For these reasons, it is unacceptable to harass, discriminate against, or abuse anyone because of race, ethnicity, gender, disability, religious affiliation, sexual orientation, or age. If you witness or are subject to such harassment, please report it to the instructor or to the Office of Diversity and Inclusion.

Disability Services:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 to schedule an appointment. The Disability Resources and Services office is located at 140 William Pitt Union, and is open Monday-Friday from 8:30AM to 5:00PM.

Title IX:

Legal text: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." As a professor I am a mandatory reporter, and I am required to report violations of Title IX that I observe or am made aware of to the Title IX office. Title IX violations include, but are not limited to, sexual harassment, sexual violence and verbal or sexual abuse. Within the classroom, behavior in violation might appear as: suggestive jokes or innuendos, inappropriate touching, and unwanted sexual behavior or advances, but my capacity and obligation to report does not end at the classroom.

PHYS 0174 Learning Objectives

1. Make a graph of the instantaneous displacement, velocity, and/or acceleration of a system based on a description of the motion or using another graph.
2. Apply the equations of 1-D kinematics to one or more objects with constant acceleration. Examples include free-fall, two objects that meet one another, and an object that has different constant acceleration at different times.
3. Add or subtract two or more vectors. (Relative velocity problems are an application of this category.)
4. Find the dot product or cross product of two vectors.
5. Describe the behavior of an object undergoing projectile motion based on the equations of 2-D kinematics.
6. Apply a conceptual understanding of Newton's first and third law.
7. Draw a free-body diagram and solve for an unknown force or acceleration of a system under the influence of two or more forces.
8. Calculate the force of static/kinetic friction or the coefficient of friction.
9. Calculate the drag force or terminal speed of an object.
10. Identify the centripetal force that acts on a system undergoing circular motion.
11. Find the work done by a force in cases were integration is not required (perhaps by inspecting a graph of force versus displacement). Alternately, find the force given work and displacement.
12. Calculate the average power provided by a force.
13. Apply conservation of mechanical energy to describe the motion of a system.
14. Use the work-energy theorem to identify the amount of mechanical energy that has been lost.
15. Calculate the average force or impulse during a collision or series of collisions.
16. Apply conservation of momentum to an explosion or collision. Be able to identify whether a collision is elastic, inelastic, or completely inelastic.
17. Answer a conceptual question about momentum, rockets, and/or the motion of the center of mass.
18. Apply kinematics to a rotating system. Be able to convert between the tangential values of s, v, a and θ , ω,

    using the radius r.
19. Distinguish between angular, tangential, and centripetal acceleration.
20. Determine the net torque acting on a body about a given axis and/or the angular acceleration of that body. Doing so may require the use of one or more moments of inertia.
21. Use the definition of static equilibrium to solve for one or more unknown forces or torques acting on a system.
22. Calculate the motion of a rolling object using torques and/or energy conservation. "Rolling" could be caused by a cord wrapped around the object, like in a yo-yo.
23. Find the rotational kinetic energy of an object.
24. Identify whether angular momentum is or is not conserved, and if appropriate, apply conservation of angular momentum to a rotating system.

25. Calculate the gravitation acceleration for an object inside or outside of a planet, given some combination of mass, radius, and density.

26. Apply energy conservation to a system with gravity to describe the motion of an object in a case where $U = mg$ is *not* an appropriate assumption.

27. Use Kepler's laws of planetary motion to describe the motion of a planet, moon, or satellite about its parent body.

28. Apply the concepts of stress, strain, and ultimate strength to a deformed object.

29. Calculate a spring constant given the elastic properties of a material.

30. Identify when a system (spring, simple pendulum, or physical pendulum) is undergoing simple harmonic motion, and find the amplitude, period, frequency, angular frequency, phase angle, displacement, velocity, and/or acceleration.

31. Apply conservation of mechanical energy to a simple harmonic oscillator (spring, simple pendulum, or physical pendulum). Damping may be involved.

32. Determine the amplitude, period, frequency, angular frequency, wave number, wave length, and/or propagation speed of a transverse traveling wave. If the wave is on a string, be able to calculate the propagation speed using the tension and linear density.

33. Predict the result of interference between two waves with identical amplitude and frequency. Specifically, be able to identify constructive, destructive, and intermediate interference—determining the amplitude and/or phase difference in the later case.

34. Identify the resonant frequencies and/or harmonics of a string or open/closed pipe.

35. Apply the equation for the Doppler effect to determine the shift in frequency caused by motion.