PHYSICS 0174: Basic Physics for Science and Engineering I

Summer 2020

Lecture: Asynchronously, plus several Thursdays 10:00-10:55AM

Recitation: As scheduled, with TA

Contact Information:

Instructor: Dr. Melanie L. Good
Virtual Office Hours: Mondays 4:00PM-5:00PM Thursdays 11:00AM-12:00PM
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. Academic honesty 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, students cheating on online physics exams were caught and received consequences described above and I will not hesitate to pursue any future cases of academic dishonesty. Assume that all online graded activities 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 Topics:

- Unit 1: Motion in One and Two Dimensions
- Unit 2: Force and Motion
- Unit 3: Energy and Work
- Unit 4: Linear Momentum
- Unit 5: Rotational Kinematics
- Unit 6: Torque and Angular Momentum
- Unit 7: Equilibrium and Elasticity
- Unit 8: Gravitation
- Unit 9: Oscillations
- Unit 10: Waves

Tentative Schedule:

Wk	Mon	Tues	Wed	Thurs
1	June 22 (Unit 1)	23 (Unit 1)	24 (Unit 1)	25 (Unit 2)
2	29 (Unit 2)	30 (Unit 2)	July 1 (Unit 3)	**2 (Unit 3)**
3	6 (Unit 3)	7 (Unit 4)	8 (Unit 4)	9 (Unit 4)
4	13 (Unit 5)	14 (Unit 5)	15 (Unit 6)	16 (Unit 6)
5	20 (Unit 7)	21 (Unit 7)	22 (Unit 8)	**23 (Unit 8)**
6	27 (Unit 9)	28 (Unit 9)	29 (Unit 10)	30 (Unit 10)

Bolded dates include required 10:00-10:55AM lecture attendance

Grading Scheme:

- 10% Attendance/Participation
- 10% Homework
- 5% Discussion Board
- 40% Exams (2 Oral Exams worth 20%/each)
- 15% Student Authored Problem Presentation(s)
- 15% Student Experimental Design Presentation(s)

See below for description of each grading component.

Attendance/Particpation (worth 10% of grade): Although most instruction will be conducted asynchronously, attendance during virtual office hours, Blackboard Collaborate meetings, and/or Zoom meetings will count towards part of your grade. To reflect that different students may have different technology constraints, the attendance will be somewhat flexible. Students must attend 4 synchronous activities, two of which must be the bolded synchronous lectures listed in the schedule above, which will be conducted either through Blackboard Collaborate or Zoom. The other two activities can be chosen according to your preferences. Available synchronous activities to choose from include Thursday lecture meetings (during non-bolded dates) or the instructor or TA's virtual office hours, or any combination of these. Each of the 4 synchronous activities will be worth 2% of your grade. You are not required to show video or turn your audio on for your attendance to count–as long as your identity is confirmed to be in attendance, you will receive attendance for that activity. However, you must **participate** in **one** of the synchronous activities. This can be asking a question through audio or chat conversation, or answering a question through audio or chat conversation. This participation (asking or answering a question) will count for 2% of your grade, so that the 4 attendances at 2% each plus one participation at 2% equals 10% of your grade in total.

Homework (worth 10% of grade): Homework assignments will be integrated into Courseweb, 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.

Discussion Board (worth 5% of grade): Each week, there will be a forum on Courseweb for students to discuss the material you are learning that week, guided in part by a "problem of the week." You will be expected to contribute at least one question and provide at least one response to another student's question. To receive full credit the question and response should be genuine and relevant to the material, not simply something along the lines of "that is a good question," "I've been wondering that too," or "Which units are included in the oral exam?"

Exams (2 Oral Exams worth 20%/each for a total of 40% of grade): During weeks 3 and 6, oral exams will take place, covering the material done in the previous two weeks. Students will coordinate with the instructor to schedule an individual 30-minute session during which the oral exam will take place on Blackboard Collaborate or Zoom (as per student's preference). **Video and audio will be required for these exams, so plan accordingly.** The instructor will pose several questions to the student, and partial credit may be given. Equation sheets may be referred to during the exam, but no other materials. If writing is required, students may elect to type, use electronic pens on virtual whiteboards, or write on regular paper and hold it up to the camera for the instructor to review. Each exam will be unique to the student, but all exams will be of equivalent difficulty, with problems chosen at random. Exams will be graded based upon a rubric, and feedback will be provided within 1 week of when the exam takes place.

Student Authored Problem Presentation(s) (worth 15% of grade): As part of the recitation activities, students will be asked to present problems of their own creation that are relevant to the material being discussed in class. **The presentations do not need to be done synchronously;** however, the presentation of these problems should also include a solution to the problem. In addition, students will be asked to upload their problem and solution to Courseweb for review. Your TA will grade these problems based on relevance, difficulty, and uniqueness.

Student Experimental Design Presentation(s) (worth 15% of grade): As part of the recitation activities, students will be asked to present descriptions of an experiment which could be used to demonstrate concepts being learned in class. **You do not need to carry out the experiments, nor do the presentations need to occur synchronously**, but your presentation of the experimental design should include a discussion of where inaccuracies and errors could take place. In addition, students will be asked to upload a written description of the experiment to Courseweb for review. Your TA will grade these experimental designs based on relevance, realistic assessment of potential errors/inaccuracies, and feasibility for the experiment to be easily carried out (in principle).

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.