PHYSICS 0174: Basic Physics for Science and Engineering I

Fall 2019

Lecture: Mon/Fri 2:00PM-2:50PM, Wed 2:00PM-3:50PM, 343 Alumni Hall

Recitation: As scheduled, with TA

Contact Information:

Instructor: Dr. Melanie L. Good
Office Hours: Mondays 4:00PM-5:00PM Tuesdays 11:00AM-12:00PM, 113D Old Engineering Hall
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).

Topics to be covered include:

- 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

Course Objectives:

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

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.

Tentative Schedule:

Wk	Mon	Wed	Fri
1	**Aug** 26 (Unit 1)	28 (Unit 1)	30 (Unit 1)
2	**Sept** 2 (No classes)	4 (Unit 1)	6 (Unit 2)
3	9 (Unit 2)	11 (**Exam 1**)	13 (Unit 2)
4	16 (Unit 2)	18 (Unit 2)	20 (Unit 3)
5	23 (Unit 3)	25 (Unit 3)	27 (Unit 3)
6	30 (Unit 4)	**Oct** 2 (Unit 4)	4 (Unit 4)
7	7 (Unit 4)	9 (**Exam 2**)	11 (Unit 5)
8	14 (Unit 5)	16 (Unit 5)	18 (Unit 5)
9	21 (Unit 6)	23 (Unit 6)	25 (Unit 6)
10	28 (Unit 7)	30 (Unit 7)	**Nov** 1 (Unit 7)
11	4 (Unit 8)	6 (**Exam 3**)	8 (Unit 8)
12	11 (Unit 8)	13 (Unit 8)	15 (Unit 9)
13	18 (Unit 9)	20 (Unit 9)	22 (Unit 9)
14	No classes	Thanksgiving Break	No classes
15	**Dec** 2 (Unit 10)	4 (Unit 10)	6 (Unit 10)
16	**FINAL EXAM**	**Wednesday 10:00-11:50AM**	

Grading Scheme:

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15% Recitation Work
10% Homework
5% In-class work
40% Midterms (Lowest one dropped)
30% Final Exam

Important Dates:
Sept 2 Labor Day– No Class
Sept 6 Add/Drop Ends
Sept 11 Exam 1
Oct 9 Exam 2
Oct 25 Withdrawal Ends
Nov 6 Exam 3
December 11 Final Exam

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.

Honor Code:

Students are expected to uphold the Universitys 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.

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.