PHYSICS 0110: Introduction to Physics I

Fall 2018

Lecture: Tues/Thurs 2:30-3:45PM

Alumni Hall 343

Recitation: **Required** with TA

Office Hours: Mon 10:30AM-11:30AM, Thurs 11:00AM-12:00PM

Contact Information:

Instructor: Melanie L. Good

Office: 113D Old Engineering Hall

Email: melanie.l.good@gmail.com or mlgood@pitt.edu

Prerequisites: MATH 0020 or any MATH greater than or equal to MATH 0031 or SAT Math Score (620 or greater) or ACT Math Score (27 or greater)

Textbook (Required): *College Physics* OpenStax `https://openstax.org/details/college-physics`

Other Required Materials: Scientific Calculator (in addition to phone or device apps, you need a separate stand-alone calculator)

Course Description: Topics to be covered include:

- Module 1: Units and Vectors (1.2-1.4, 2.2)
- Module 2: One-Dimensional Kinematics (Ch.2)
- Module 3: Two-Dimensional Kinematics (Ch.3)
- Module 4: Newton's Laws of Motion (without friction) (Ch.4, 6.5)
- Module 5: Newton's Laws (with friction) (5.1, 5.2, 6.1-6.4)
- Module 6: Work and Energy (Ch.7)
- Module 7: Impulse and Momentum (Ch.8)
- Module 8: Torque, Angular Dynamics, and Angular Momentum (Ch.9, 10.1-10.5)
- Module 9: Oscillatory Motion (16.1-16.6, 5.3)
- Module 10: Fluids (Ch.11, 12.1-12.4)
- Module 11: Temperature, Heat, and Thermal Expansion (13.2, 14.1-14.3)
- Module 12 and 13: Waves and Sound (Ch. 16, Ch. 17)

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_0100_LearningObjectives_2017%20%282%29.pdf :

PHYS 0110 Learning Objectives

Module 1. You should be able to: explain the difference between units and dimensions; write a value in scientific format with a sensible number of significant figures; use dimensional analysis to detect a dimensional inconsistency; apply basic geometry results; use trigonometric functions; explain the difference between a scalar and a vector; calculate the magnitude of a vector in two dimensions; add, subtract and decompose vectors in two dimensions.

Module 2. You should be able to: calculate the speed of an object moving in one dimension; calculate the displacement of an object moving with constant velocity in a fixed direction; calculate the displacement of an object moving with constant acceleration in a fixed direction; mathematically describe the free fall of an object, neglecting air resistance; derive the time of descent of an object.

Module 3. You should be able to: write the kinematics equations in more than one dimension; calculate the displacement of an object; find the coordinates and velocity components of a projectile; qualitatively apply the concept of inertia; apply the relation between force and acceleration in one and two dimensions; apply the action-reaction principle.

Module 4. You should be able to: distinguish contact forces from fundamental forces; apply the law of universal gravitation to two objects; draw a free body diagram for an object acted upon by no more than four forces; find tension, normal forces, gravitational force on an either stationary or moving object; consistently identify the boundaries of a mechanical system; solve Newton's second law problems for a mechanical system.

Module 5. You should be able to: distinguish between static and kinetic friction; find the coefficient of friction with and without motion; explain the occurrence of terminal velocity in a fluid; find angular position, angular displacement, and angular velocity; find speed and forces on an object performing uniform circular motion; apply Newton's second law for an objects performing uniform circular motion.

Module 6. You should be able to: apply the concept of work of a force; calculate the work of a constant force; apply the work-energy theorem; apply the principle of conservation of energy; find the work done by non-conservative forces in a mechanical system; calculate the power of a force.

Module 7. You should be able to: calculate the impulse of a constant force; apply the impulse-momentum theorem; distinguish between individual and total linear momentum; apply the principle of conservation of total linear momentum; calculate either initial or final velocities in completely elastic and completely inelastic collisions.

Module 8. You should be able to: describe a rigid rotation using angular displacement, angular velocity, angular acceleration; relate linear variables with angular variables; calculate the torque of a force; apply the right-hand rule for direction of a cross product; apply Newton's second law for rigid rotation; use the concept of moment of inertia; determine conditions for

static equilibrium of a rigid body; apply the relation between work of torque and rotation energy; apply the principle of conservation of total angular momentum.

Module 9. You should be able to: describe simple harmonic motion of a mass attached to an ideal spring; calculate the work done by an elastic force; apply generalized Hooke's law for longitudinal stress and shear stress; describe simple harmonic oscillations of a pendulum; distinguish between simple and physical pendulum; calculate period of a physical pendulum.

Module 10. You should be able to: qualitatively use the concept of pressure; apply Pascal's principle; calculate a buoyant force; apply the equation of continuity; apply Bernoulli's principle for ideal fluids; understand the origin of viscosity; calculate the pressure drop due to viscous flow.

Module 11. You should be able to: distinguish between concepts of temperature and heat; use the idea of thermal equilibrium; calculate the energy needed to change the temperature of an object; calculate the energy needed to change the phase of an object; calculate the geometric expansion of a material when heat is added or removed.

Module 12. You should be able to: distinguish a transverse wave from a longitudinal wave; mathematically describe a traveling wave, both transverse and longitudinal; find the distance traveled by a wave in given conditions; find the wavelength and frequency of a wave; find the speed of a wave on a taut string; find the speed of sound at different temperatures; calculate the power of a sound source and the intensity of a sound wave.

Module 13. You should be able to: calculate the frequency shift of sound due to relative motion between source and observer; apply the principle of linear superposition to traveling waves; apply geometrical conditions for constructive or destructive interference between two waves; find the wavelength or frequency of various modes of vibration in transverse and longitudinal standing waves.

Structure of Class:

Research has shown that student learning is optimized when students are actively engaged in their learning, so this course will make use of evidence-based approaches to facilitate active engagement. In order to gain the most benefit from these approaches, you will need to be an equal partner in the learning process, which will involve in-class discussions, group problem-solving, and coming to class prepared to engage with the content (for example, reading the relevant material in the textbook prior to lecture). Being equal partners in the learning process means that I will arrive to class prepared to serve and support you in your learning through interactive demonstrations, thought-provoking discussion questions, and carefully designed activities. I will also listen intently to any difficulties you encounter, be sensitive to the diversity of backgrounds of my students, and be accessible to you during my office hours and via email.

Each of the Modules related to the Learning Objectives will typically comprise 2 classes. Before the first class in each Module, you will be expected to have read the relevant chapter in your textbook and to have taken a reading quiz on Courseweb to help you think about what you have read. Then during the first class, you will be given a brief overview of the material for that module, via PowerPoint presentation, with conceptual discussion questions interspersed throughout the lecture. This will give you a chance to think about the material and discuss it with your peers, and receive credit for your discussions via electronic clicker response. In addition, I will typically incorporate at least one demonstration in class. You will be asked to participate in these demonstrations by predicting what you believe the outcome will be, based upon what you have learned in the Module. After this, you will be invited to practice optional back-of-the-chapter and/or online problems in preparation for the third class of the Module. Then in the second class, I will present example problems related to the Module and you will work in groups on a problem-solving exercise, during which time I will be available, as I circulate around the lecture hall, to provide support and answer questions as you engage in the problem-solving process. This is where the learning becomes truly student-centered, and is meant to help you synthesize the concepts and example problems that have been discussed. At this point, you will have also received additional practice with solving contextually-rich realistic problems from the Module in recitation.

Exceptions to this general routine will be the first week of class, and weeks before and after exams, in which the demonstrations will be replaced by announcements, review and/or going over tests. Also in the week before an exam, you will engage in groups in a student-authored problem activity instead of the typical group problem-solving activity. These student-authored problems may appear on the exams.

Learning involves productive struggle, and chances to improve. As such, exams are seen as part of the learning and growing process, and you will be given the chance to re-do your exam in order to earn back a portion of the possible points on missed questions. These opportunities are there to help you refine your understanding and build your confidence. My hope is that by the end of the semester, you will view the subject of physics as interesting and understandable when we work effectively towards unraveling its mysteries.

Grading Scheme:
20% Recitation work
10% Homework reading quizzes
20% In-class clicker responses
20 % Group problems
10% Exam 1
10% Exam 2
10% Final Exam
up to +2.5% Bonus available

Important Dates:
Sept. 7 Add/Drop Ends
Sept. 25 Exam 1
Oct. 15 Fall "Break" (No classes)
Oct. 16 Monday classes meet, even though it's Tuesday
Oct. 26 Withdrawal Ends
Oct. 30 Exam 2
Dec. 11, 8:00AM-9:50AM Final Exam

***Exam 1 and 2 dates subject to change at the instructor's discretion**

Tentative Schedule:

Week	**Tues**	**Thurs**
1	**Aug.** 28 (M1)	30 (M1)
2	**Sept.** 4 (M2)	6 (M2)
3	11 (M3)	13 (M3)
4	18 (M4)	20 (M4)
5	**25 (Exam1)**	27 (M5)
6	**Oct.** 2 (M5)	4 (M6)
7	9 (M6)	11 (M7)
8	X	18 (M7)
9	23 (M8)	25 (M8)
10	**Oct. 30 (Exam 2)**	**Nov.** 1 (M9)
11	6 (M9)	8 (M10)
12	13 (M10)	15 (M11)
13	20	X
14	27 (M11)	29 (M12)
15	**Dec.** 4 (M12-13)	6 (M13)
16	**Final Exam: Tuesday, Dec. 11**	**8-9:50AM**

X = No Class

M1, M2, etc. = Module 1, Module 2, etc.

Homework:

Your homework will consist of reading the textbook, taking reading quizzes, and practicing back-of-the-chapter and/or problems. Some of these activities (namely the reading quizzes) impact your grade directly, while others will have an indirect effect on other components of your grade. For example, careful reading of the textbook and practicing problem-solving will typically result in better test performance than skipping these activities.

Group Work:

Group work will be essential in both lecture and recitation class time. Collaborating on problem-solving helps allow you to co-construct knowledge with your peers and tackle complex problems together. The context-rich problems given in recitation demand careful and deliberate problem-solving strategies, including conceptual analysis of the problem prior to planning and implementing your solution, and this kind of practice will help avoid the temptation to superficially "plug and chug" an answer without deeper understanding. The deeper understanding you gain will help you see connections to problems that utilize the same underlying principles, even if they superficially appear dissimilar, and that kind of transfer skill will allow you to solve problems better on exams. Finally, authoring your own problem together as a group will help you think critically about the material you are learning, and will allow you to understand the problem-solving process from a different angle, which can benefit your learning.

Clickers:

We will make extensive use of clickers for conceptual discussion questions, and as a means of responding to group problem-solving activies and demonstration predictions. Clicker questions will be formatted as multiple choice questions; however, you will receive 80% credit simply for participating in the clicker response. Should you get the correct answer, then you will receive 100% credit for that question. You do not have to give the same response as the other members of your group–your clicker responses are confidential and individual. Discussions among your group helps you think about what you believe the answer might be, but ultimately you are free to take a dissenting position from the members of your group.

Exams:

Exams will be mainly multiple choice, with 1-3 open-ended questions as well. The exams are viewed as a learning experience, and you will have the opportunity to re-do the exams in order to earn back a portion of any points you missed. The re-dos will take place during the recitation after the exam, and the version you receive may not contain the exact same numbers as the version you took in class.

Bonus Opportunities:

The Physics Exploration Center (PEC) was developed to help the students in the introductory Physics and Astronomy classes to more deeply understand the subject matter they are studying . To that end, at any given time, there are several self-guided experiments set-up in the PEC that the students can work through and investigative the concepts that they are studying in their classes . On average, this translates into a few new experiments being set-up each week. Each experiment remains in the PEC for a minimum of one week after that time the amount of usage and available space will determine how long an experiment is displayed in the PEC. The PEC is located in Thaw 312 adjacent to the Physics Resource Room. It is open generally from 9:00 am to 4:00 pm Monday to Friday, whenever Teaching Assistants (TA's) are available in the Resource Room. `http://www.phyast.pitt.edu/~pec/Student_Web_Site/Course%20Instructors/List_all_Courses.htm` Bonus credit will be given for completed PEC lab reports, which you will submit to

your TA, **within one week of when each lab has been removed from the PEC**. You can earn up to 2% bonus added to your final grade for completion of the PEC labs (completion of ALL labs will earn you 2% bonus; less than all labs will earn you a smaller amount of bonus).

In addition, you can earn up to 0.5% bonus for critiquing of your textbook. This can include errors or issues of equity of representation. For example, perhaps a female scientist contributed to a discovery but was not credited, or perhaps depictions of people in pictures and/or diagrams fail to include underrepresented groups. To receive credit for your critique, you must critique only the chapters covered in class and you must reference where in the textbook your critique refers to and what you find problematic about it. These will be submitted directly to me. **The deadline for submitting textbook critiques is Friday, Nov. 16.**

Attendance:

Since 40% of your grade comes from in-class activities (group work and clicker responses), your attendance is absolutely crucial for obtaining a good grade. If you must miss class for health-related reasons, you should notify me in advance of your absence. If you must miss class for an emergency, please notify me as soon as you possibly can. Whether or not you are excused from in-class assignments will be at my discretion. Generally-speaking, if you have been absent more than three times, I will request a doctor's note to justify excusing any further absences. If an absence is unexcused, you will not receive credit for in-class graded activities. If an absence is excused, the activities will be excused from your grade, but there will not be time in the schedule to afford makeups of those activities. Therefore, you will be responsible for ensuring that you understand the material, concepts, and problems that have been covered in class, as you will still be expected to utilize this understanding on exams and/or recitation work. Feel free to ask members of your group to share any information they have about what you missed, including any group work problems that were worked out. Even if you do not receive credit for them, it will be good for you to know what was done in class.

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.

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.