# PHYS 103: Fundamental Physics I

Fall 2017

**Location:** Trexler 372 **Time:** MWF 08:30-9:30

**Instructor:** Jarrett L. Lancaster **Email:** jlancaster@roanoke.edu

**Office Hours:** MWF 12:00–13:00, Tue/Thu 13:00-14:30 **Office:** Trexler 264B

**Text:** Randall D. Knight, Brian Jones and Stuart Field, *College Physics: A Strategic Approach*, 3rd ed., Pearson, 2014.

**ISBN:** 978-0321879721

**Prerequisites:** None

**Other required materials:** You will need to purchase access to the WebAssign online homework management system (http://www.webassign.net) in order to complete assignments. Detailed instructions can be found below. Additionally, you will likely want to have a *working* scientific calculator for in-class assignments and exams.

## Course Description

The first half of a full-year elementary physics course, using trigonometry (but not calculus) with emphasis on biological applications of physics. Topics to be discussed include motion in 1, 2 and 3 dimensions; Newtons laws; conservation of momentum and energy; rotational motion; fluids; waves and sound.

## Why Is This Course Important?

Admittedly, many of you do not plan to use physics directly in your future careers. This does not mean that putting in the significant effort required to master this material is a waste of your time–quite the opposite. The development of Newtonian mechanics represents one of the greatest intellectual achievements of human beings. Taking the plunge to understand this framework is a valuable lesson in problem solving, which is a *very* portable skill. Wherever you find yourself, there will be problems requiring the type of critical thinking one develops in a careful study of physics.

## Goals

Upon successful completion of the course, students will be able to:

- Identify relevant physical principles which underlie the dynamics of real-world situations.
- Parse pertinent numerical information from superfluous within contextual physics problems.
- Manipulate units as a viable source of knowledge about the physical world.
- Construct organized physical analyses that demonstrate logically connected steps of thought.

- Synthesize numerical information, physical assumptions, and previous concepts to correctly describe physical systems.

- Apply analytical thinking and physical modeling to other scientific arenas.

Most importantly, your goal is **not** to memorize equations or particular problems. The subject is difficult, and anyone who tells you otherwise is being dishonest with you (or him/herself). As an exam approaches, you might be tempted to put most of your effort into simply memorizing as many solutions as your mind can handle. This is counterproductive, and it will only lead to frustration. **Relevant equations are provided on all exams** because it is a waste of time to memorize formulas when the act of learning takes place through *using* these formulas.

## Attendance

We will regularly work problems, discuss, and take quizzes within the class hour, which will provide an opportunity to highlight a student's absence. Due to the mathematically rigorous nature of the course, you may not miss more than four classes without a legitimate excuse (court, hospital, police, etc.). **Late arrivals greater than 5 minutes will constitute an official absence. A fifth unexcused absence will result in a automatic drop (DF) from the course.**

## Method of Instruction

You can only learn physics by falling down and learning how to pick yourself up again. At times it can be painful, embarrassing and frustrating–just like most worthwhile endeavors that lead to personal growth. To mitigate these challenges, the course is structured so that you have ample opportunities to practice your newly learned analytical skills before the stakes become high. These stages are briefly summarized as:

### 1. Pre-class reading

There is assigned reading in the textbook before every class meeting (except for day one and exam days). It is extremely important that you complete these readings. The goal is not to gain a deep understanding of every new concept, as this simply cannot be done by passively reading a textbook. Rather, this is initial immersion into the ideas and terminology. You should make every attempt to gain as much as you can from these readings, but do not feel that you are supposed to understand everything after a first pass. The subsequent steps rely on this initial exposure, **so you will be required to answer a pre-class question before each class meeting and turn in your answer.**

### 2. Class time

Your responses will help to guide a brief synopsis of the main topics for each day of class. I won't cover everything contained in those readings, but just the unifying concepts and how they relate to topics we have already encountered. The remainder of the class will be spent tackling conceptual

questions and more-involved examples, which will require you to think individually and discuss your reasoning with your fellow students.

### 3. Homework/Tutorial

Your homework will consist of weekly assignments using the WebAssign platform (see URL below). Problems may be attempted several times with no loss in points for the first few incorrect attempts. Correctness is ultimately required to secure full credit.

### 4. Pre-exam practice

A week before each exam, I will prepare a short list of exercises which encapsulate the material to be tested on the exam. The exam will **not** be a carbon copy of this handout, but if you truly understand all concepts involved in this practice set, you should have no difficulty in successfully handling the real exam.

## Evaluation

### Exams

There will be three mid-term exams and a cumulative final exam. Exams will include multiplechoice questions as well as questions involving written solutions. The exam dates are:

- Exam 1: September 22, 2017
- Exam 2: October 27, 2017
- Exam 3: December 1, 2017
- Final Exam: December 15, 2017 (08:30–11:30)

You will be supplied with a list of equations for each exam, which will be made available to you no later than during class preceding the exam. Use of a scientific calculator on the exams is allowed. Make-up exams will **only** be allowed as a result of a discussion with me beforehand (with *very* compelling reason) or in emergency situations (death, hospitalization, court, etc.).

### Homework

Assignments will be roughly weekly in frequency and administered through WebAssign: http://www.webassign.net.

You will need to purchase an access code ($22.50) and use the *course key* roanoke 0249 8192 to log in to the system.

## Pre-class reading questions

**Each pre-class reading will be accompanied by a conceptual question which must be turned in at the beginning of the next class meeting.** Each response will be marked as satisfactory or unsatisfactory. A satisfactory answer doesn't have to be entirely correct, but it must demonstrate a reasonable effort to answer the question.

## In-class assignments

Handouts corresponding to each unit we cover will be issued in class. These handouts will contain a brief summary of the relevant principles as well as several exercises. Roughly half of each class will be devoted to solving these problems in groups with instructor assistance. Each handout will have a due date and must be turned in for "spot check" grading.

## Reflection

Toward the end of the semester, you will be asked to turn in a reflection essay about how the material in this course is relevant to your desired degree. More information about this assignment will be provided to you before Fall Break.

## Lab

You **must** be enrolled in the laboratory portion (PHYS 103L) in addition to the current course. PHYS 103L operates as a separate course, but it counts as 25% of the course grade for PHYS 103. Please consult the lab course syllabus for information on the lab grade. **If any lab experiment is not performed by the end of the semester, your course grade will be reduced by one whole letter grade.**

## Grading

Your grade will be determined from the following formula:

30% Three midterm exams (10% each)
25% Lab
15% Final exam
15% Homework
10% In-class work/pre-class reading questions
5% Reflection essay

The following grading scale will be employed:

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|---|---|---|---|---|---|---|---|
| A | 93-100 | B | 83-86.9 | C | 73-76.9 | D | 63-66.9 |
| A- | 90-92.9 | B- | 80-82.9 | C- | 70-72.9 | D- | 60-62.9 |
| B+ | 87-89.9 | C+ | 77-79.9 | D+ | 67-69.9 | F | <60 |

Extra credit is available for students who attend a talk in the MCSP Conversation Series (schedule available at http://cs.roanoke.edu/MCSPSeries) and submit a well-written reflection on the talk **within one week of the presentation**. The requirements for the submission are:

1. a brief summary of the key ideas of the talk
2. a vivid description of the parts of the presentation that were interesting, confusing and relevant to this course
3. an overall critique of the presentation, and (if appropriate) the content
   Your submission must be typed, double-spaced, between one and two pages in length and employ proper grammar. Each student may submit up to two such papers during the semester, and each paper will earn 0, 1, or 2 points to be added to your final grade. **Note: a simple summary of the talk is not sufficient to receive credit.**

# Additional Policies

## Academic Integrity

I will follow the college Academic Integrity (AI) policy, and you are responsible for knowing and following the college policy as well. Online responses to required readings must be completed individually. General concepts related to WebAssign exercises may be clarified through conversations with other students, but you should solve the problems on your own. If I become aware of a possible violation of these guidelines, I am obligated report it to the Academic Integrity committee. The full AI policy can be found online at: http://roanoke.edu/A-Z Index/Registrar/Policies and Information/Academic Integrity.htm.

## Late Work Policy

The course material builds upon itself, so it is important for you to receive rapid feedback on your work. Answers to WebAssign problems will be available immediately after the due date. If you have an illness or excused absence which prevents you from completing work, and notify me *before* this due date comes to pass. Makeup exams are only given in the most extreme situations, but the final exam grade may be substituted for a missed exam due to an excused absence. If your missed exam is unexcused, you will receive a zero on the missed test.

## Disability Support Services

The Office of Disability Support Services, located in the Good-Pasfield Center for Learning and Teaching in Fintel Library, provides reasonable accommodations to students with identified disabilities. Reasonable accommodations are provided based on the diagnosed disability and the recommendations of the professional evaluator. In order to be considered for disability services, students must identify themselves to the Office of Disability Support Services. Students requesting accommodations are required to provide specific current documentation of their disabilities. Please contact Ms. Joann Stephens-Forrest, Coordinator of Disability Special Services, by phone at (540) 375-2248 or by email at stephens@roanoke.edu.

### Use of Electronic Devices

In class, you may use personal laptops and tablets, but only for the purpose of taking notes. All other electronic devices must be turned off. On tests, you may use a scientific calculator; all other electronic devices must be turned off and out of sight. **Violation of this policy on tests will be treated as a violation of the Academic Integrity policy.**

## Proposed Schedule

The following schedule outlines the timeline for the topics to be covered and highlights the reading for which you are responsible. Also pay close attention to the timing of exams and assignments.

**You should expect to spend at least 12 hours inside and outside of class each week on this course.**

| Day | Chapter | Topic | HW Due | Pre-class reading | HW topic |
|---|---|---|---|---|---|
| 30 Aug | 0 | Math | | buy book | |
| 1 Sep | 1 | Motion | | 1.1–1.6 | |
| 4 Sep | 2 | Speed, velocity, acceleration | | 2.1-2.4 | |
| 6 Sep | 2 | Motion Problems | | 2.5-2.6 | |
| 8 Sep | 2 | Free-fall, intro to 2D | | 2.7 | |
| 11 Sep | 3 | Vectors | HW1 | 3.1-3.3 | (Chapters 1-2) |
| 13 Sep | 3 | 2D Motion (ramp) | | 3.4-3.5 | |
| 15 Sep | 3 | Projectiles, circular motion | | 3.6-3.7 | |
| 18 Sep | 4 | Forces (example, springs) | HW2 | 4.1-4.4 | (Chapter 3) |
| 20 Sep | 4 | Newton's second law | | 4.5-4.6 | |
| 22 Sep | **Exam 1** | **Chapters 1-3** | | | |
| 25 Sep | 4 | Newton's third law | | 4.7 | |
| 27 Sep | 4,5 | Equilibrium and dynamics | | 5.1-5.3 | |
| 29 Sep | 5 | Familiar forces | | 5.4-5.6 | |
| 2 Oct | 5 | Pulleys and systems | HW3 | 5.7-5.8 | (Chapter 4) |
| 4 Oct | 6 | Circular motion | | 6.1-6.2 | |
| 6 Oct | 6 | Gravity and orbits | | 6.4-6.6 | |
| 9 Oct | 7 | Rotational motion | HW4 | 7.1-7.3 | (Chapters 5-6) |

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|---|---|---|---|---|---|
| 11 Oct | 7 | Newton's 2nd law/rolling | | 7.4-7.7 | |
| 13 Oct | 8 | Static Equilibrium | | 8.1-8.2 | |
| 16 Oct | | **Fall Break** | | | |
| 18 Oct | | **Fall Break** | | | |
| 20 Oct | | **Fall Break** | | | |
| 23 Oct | 9 | Momentum Conservation | HW5 | 9.1-9.4 | (Chapters 6-8) |
| 25 Oct | 9 | Collisions | | 9.5-9.6 | |
| 27 Oct | **Exam 2** | **Chapters 4-8** | | | |
| 30 Oct | 9 | Angular Momentum | | 9.7 | |
| 1 Nov | 10 | Work-energy principle | | 10.1-10.3 | |
| 3 Nov | 10 | Conservation of energy | HW6 | 10.4-10.6 | (Chapters 9-10) |
| 6 Nov | 10 | Applications of energy | | 10.7-10.8 | |
| 8 Nov | 11 | Temperature and energy | | 11.1-11.3 | |
| 10 Nov | 11 | First law of thermodynamics | HW7 | 11.4-11.5 | (Chapters 10-11) |
| 13 Nov | 12 | Ideal gas law, kinetic theory | | 12.1-12.3 | |
| 15 Nov | 12 | Specific heat, thermal expansion | | 12.4-12.8 | |
| 17 Nov | 13 | Fluids and buoyancy | HW8 | 13.1-13.4 | (Chapters 11-12) |
| 20 Nov | 13 | Fluid dynamics | | 13.5-13.6 | |
| 22 Nov | | **Thanksgiving** | | | |
| 24 Nov | | **Thanksgiving** | | | |
| 26 Nov | 14 | Simple harmonic motion | HW9 | 14.1-14.3 | (Chapter 13) |
| 29 Nov | 14 | Energy, the simple pendulum | | 14.4-14.5 | |
| 1 Dec | **Exam 3** | **Chapters 9-13** | | | |
| 4 Dec | 15 | Light and sound waves | | 15.1-15.4 | |
| 6 Dec | 15 | Intensity, loudness and Doppler | | 15.5-15.7 | |
| 8 Dec | | REVIEW | HW10 | | (Chapters 14-15) |
| 15 Dec | **Final Exam** | **8:30-11:30** | | | |