PHYS 103B: Fundamental Physics I

Fall 2016, MWF 9:40-10:40
Trexler 372

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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; Newton's laws; conservation of momentum and energy; rotational motion; fluids; waves and sound.

Required Texts

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

ISBN: 978-0321879721

You will also need to purchase access to the WebAssign online homework management system for access to assignments. Instructions for this will be emailed to you before the first class meeting. Additionally, you will likely want to have a working scientific calculator for exams.

While we will follow the latest edition of the text, an older (much cheaper) edition contains essentially the same material and will be sufficient for reading. If you choose to purchase an older edition, please note that the required readings will require some modest changes, as material tends to shift into different sections between editions. Do not hesitate to ask me about how the reading assignments can be adapted to older editions of this textbook.

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 –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. As a bonus, you'll also learn enough about classical physics to be able to make snarky comments to your peers about how Hollywood films (almost) always get the science wrong (Punch the name "Rhett Allain" into Google for examples).

Goals

1. A clear, conceptual understanding of Newtonian mechanics
2. Improved skill in analytical reasoning developed through a structured application of Newtonian mechanics to a variety of physical situations.
3. An appreciation for the usefulness of Newtonian mechanics as it applies to nature, biology and technology.

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 (though not labeled) on all exams** because it's a waste of time to memorize formulas when the act of learning takes place through ***using*** these formulas.

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 are required to face several attempts to practice your newly learned analytical skills before the stakes become high (such as during exams). These stages are briefly summarized as:

1. Pre-class reading/question

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 a sort of 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 simply 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 on WebAssign related to each reading assignment. This question must be answered by 12AM the day of each class meeting**.

2. Class time

Decades of research have shown that students learning physics do not benefit from an instructor who spends the entire class talking at his/her pupils. Your online 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 the relate to topics we have already encountered. The remainder of the class will be spent tackling conceptual questions, which will require you to think individually and discuss your reasoning with your fellow students. Each class will end with a demonstration exercise or two, which I'll work on the board to outline how the day's topics can be used to solve problems similar to those found in your homework assignments.

3. Homework/Tutorial

Your homework will consist of weekly assignments using the WebAssign platform (see URL below). Problems are drawn from the textbook and may be attempted several times with no loss in points for the first few incorrect attempts. Correctness is ultimately required to secure credit. You may find it helpful (or necessary) to attend a weekly tutorial I hold for a portion of my office hours. Details will be communicated in class and documented on Inquire. The main focus of these tutorial sessions will be to answer specific questions you have about your homework, but I'll also prepare some additional demonstration problems (similar to your homework questions).

4. Pre-exam practice

A week before each exam, I'll 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. **You are required to turn in this material for a grade**. While I encourage you to discuss general concepts relevant to the solutions with you peers, your solutions must represent your individual attempt at the solutions.

Evaluation

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

Exam 1: September 23, 2016
Exam 2: October 28, 2016
Exam 3: December 2, 2016
Final Exam: December 14, 2016 (8:30-11:30AM)

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.

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

You will need to purchase an access code ($29.95) and use the course key **roanoke 3517 6636** to log in to the system.

Pre-class reading questions
Each pre-class reading will be accompanied by a conceptual question, which may be answered through Webassign. You must answer this question in your own words by 12:00AM on the day of each 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. You begin the semester with five points. After five incomplete (unexcused) or unsatisfactory responses, each unsatisfactory response drops your overall score by one point.

Pre-exam worksheets
These assignments are meant to be practice for each exam. They will be assigned no later than one week before each scheduled exam and due in class on the day of the relevant exam. Each student must submit an individual, handwritten set of solutions.

Lab
Please consult the lab course syllabus for information on the lab grade. **If any lab is not turned in 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 mid-term exams (10% each)
25%	Lab
15%	Homework
15%	Final exam
10%	Pre-exam handouts
5%	Pre-class reading questions

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. 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.

The following grading scale will be employed:

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

Additional Policies

Academic Integrity

I will follow the college Academic Integrity 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. Purchasing a solution manual to the textbook is a clear violation of the Academic Integrity policy. You may discuss problems in more depth with me or other RC approved tutors/physics faculty. If I become aware of a possible violation of these guidelines, I am obligated report it to the Academic Integrity committee.

Late Work Policy

The course material builds upon itself, so it's important for you to receive rapid feedback on your work. Solutions to WebAssign problems will be available shortly after the due date. If you have an illness or excused absence which prevents you from doing an online pre-class reading response or WebAssign problem, and notify me before this due date comes to pass. I will post pre-exam worksheet solutions at 5:00pm on the due date, so no late worksheets can be accepted. Only in extreme circumstances will I exempt a student from a worksheet assignment. If you have a compelling reason to miss an exam, please inform me as soon as possible. If your test absence is unexcused, you will receive a zero on the missed test. There are no makeup exams, but in the very rare case of excused absences the final exam grade can be substituted for any exam that is missed due to a valid excuse. Please see the laboratory syllabus for the policy on late labs. You must complete all labs by the end of the semester. **If any lab is not completed by the end of the semester, your course grade will be reduced by one whole letter grade.**

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.**

Schedule

Below is an approximate schedule of topics to be covered (due dates and exam dates are rigid, but assignments and exam material may be adjusted depending on the pace of the course). **Students should expect to spend at least 12 hours inside and outside of class each week completing assignments and preparing for exams.**

Day	Chapter	**Topic**	**HW Due**	**Pre-class reading**	**HW topic**
31-Aug	0	Math		buy book	
2-Sep	1	Motion	Pretest	1.1-1.6	
5-Sep	2	Speed, velocity, acceleration		2.1-2.4	
7-Sep	2	Motion Problems		2.5-2.6	
9-Sep	2	Free-fall, intro to 2D		2.7	
12-Sep	3	Vectors	HW1	3.1-3.3	(Chapter 1-2)
14-Sep	3	2D Motion (ramp)		3.4-3.5	
16-Sep	3	Projectiles, circular motion		3.6-3.7	
19-Sep	4	Forces (example, springs)	HW2	4.1-4.4	(Chapter 3)
21-Sep	4	Newton's second law		4.5-4.6	
23-Sep	**Exam 1**	**Chapters 1-3**			
26-Sep	4	Newton's third law		4.7	
28-Sep	4,5	Equilibrium and dynamics		5.1-5.3	
30-Sep	5	Familiar forces		5.4-5.6	
3-Oct	5	Pulleys and systems	HW3	5.7-5.8	(Chapter 4)
5-Oct	6	Circular motion		6.1-6.2	
7-Oct	6	Gravity and orbits		6.4-6.6	
10-Oct	7	Rotational motion	HW4	7.1-7.3	(Chapters 5-6)
12-Oct	7	Newton's 2nd law/rolling		7.4-7.7	
14-Oct	8	Static Equilibrium		8.1-8.2	
17-Oct		**Fall Break**			
19-Oct		**Fall Break**			
21-Oct		**Fall Break**			
24-Oct	9	Momentum Conservation	HW5	9.1-9.4	(Chapters 6-8)
26-Oct	9	Collisions		9.5-9.6	
28-Oct	**Exam 2**	**Chapters 4-8**			
31-Oct	9	Angular Momentum		9.7	
2-Nov	10	Work-energy principle		10.1-10.3	
4-Nov	10	Conservation of energy	HW6	10.4-10.6	(Chapters 9-10)
7-Nov	10	Applications of energy		10.7-10.8	
9-Nov	11	Temperature and energy		11.1-11.3	
11-Nov	11	First law of thermodynamics	HW7	11.4-11.5	(Chapters 10-11)
14-Nov	12	Ideal gas law, kinetic theory		12.1-12.3	

16-Nov	12	Specific heat, thermal expansion		12.4-12.8	
18-Nov	13	Fluids and buoyancy	HW8	13.1-13.4	(Chapters 11-12)
21-Nov	13	Fluid dynamics		13.5-13.6	
23-Nov		**Thanksgiving**			
25-Nov		**Thanksgiving**			
28-Nov	14	Simple harmonic motion	HW9	14.1-14.3	(Chapter 13)
30-Nov	14	Energy, the simple pendulum		14.4-14.5	
2-Dec	**Exam 3**	**Chapters 9-13**			
5-Dec	15	Light and sound waves		15.1-15.4	
7-Dec	15	Intensity, loudness and Doppler		15.5-15.7	
9-Dec		REVIEW	HW10		(Chapters 14-15)
16-Dec	**Final Exam**	**8:30-11:30**			