

# PHYS 104B: Fundamental Physics II

Spring 2017, MWF 9:40-10:40 Miller  
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**Office hours:** MWF 11:00-12:00, Thursday 1:10-2:10, also by appointment

*See Inquire for the most recent version of this document*

## Course Description

The second 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 electrostatics, basic DC circuitry, geometric/wave optics and elements of quantum theory.

## Required Texts

Randall D. Knight, Brian Jones and Stuart Field, *College Physics: A Strategic Approach*, 3<sup>rd</sup> 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 discussed during the first day of class. 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?

With a hearty semester of basic physics under our belts, we are now undertaking a complete and systematic study of electromagnetism –one of the four fundamental forces in nature. While you might initially feel that the only overlap between this subject and your everyday life is flipping on the light switch or mindlessly playing with magnets, we will see that electromagnetism is responsible for everything from light to the normal force provided by the ground which keeps you from falling through the floor. By developing a quantitative description of the theory of electromagnetism and exploring its consequences, you will gain a deep appreciation for how numerous seemingly unrelated phenomena can be explained by a simple set of a few rules.

## Goals

1. A clear, conceptual understanding of electromagnetism and optics

2. Improved skill in analytical reasoning developed through a structured application of classical physics to a variety of situations.
3. An appreciation for the usefulness of electromagnetism as it applies to nature, biology, chemistry 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 preclass question on WebAssign related to each reading assignment. This question must be answered by 8AM 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 they 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: February 10, 2017

Exam 2: March 17, 2017

Exam 3: April 12, 2017

**Final Exam: April 27, 2017 (2:00-5:00PM)**

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 5770 1016** to log in to the system.

### **Pre-class reading questions**

Each pre-class reading will be accompanied by a multiple choice or free-response conceptual question, which may be answered through Inquire. 5% of your final grade will come from a raw average of correct responses.

### **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. A key (numerical answers only) will be made available the day before the test, and you should feel free to ask me to look over your solutions any time before that date.

## 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

To make grade reporting as transparent as possible this semester, your grade will be a simple average of points. The number of available points for each category is as follows:

Midterms	375 points (3 at 125 each)
Lab	315 points
WebAssign Homework	250 points
Final Exam	185 points
Pre-exam handouts	66 points
Pre-class questions	68 points
Final Grade	$(\text{Total points}/1259)*100\%$

This works out to the following approximate distribution:

30%	Three mid-term exams (10% each)
25%	Lab
20%	Homework
15%	Final exam
5%	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. 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 Goode-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](mailto: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.**

16-Jan		Overview			
18-Jan	16	Standing waves		16.1-16.4	
20-Jan	16	Interference		16.5-16.7	
23-Jan	20	Charge and Coulomb's Law	HW1	20.1-20.3	(Chapter 16)
25-Jan	20	Electric Fields, Conductors		20.4-20.6	
27-Jan	20	Forces, energy		20.7-21.1	
30-Jan	21	Electric Potential	HW2	21.1-21.3	(Chapter 20)

1-Feb	21	Fields and Potentials		21.4-21.6	
3-Feb	21	Capacitors, ECG		21.7-21.8	
6-Feb	22	Electric current	HW3	22.1-22.3	(Chapter 21)
8-Feb	22	Ohm's Law		22.4-22.6	
<b>10-Feb</b>	<b>Exam 1</b>	<b>Chapters 16, 20-21</b>			
13-Feb	23	Intro to circuit diagrams	HW4	23.1	(Chapter 22)
15-Feb	23	Kirchoff's Laws		23.2-23.3	
17-Feb	23	Series, Parallel and worse		23.3-23.5	
20-Feb	23	RC Circuits		23.6-23.8	
22-Feb	24	Magnetic Fields		24.1-24.3	
24-Feb	24	Fields, Forces and Wires		24.4-24.6	
27-Feb	24	Magnets	HW5	24.8	(Chapters 23-24)
1-Mar	25	Induction		25.1-25.3	
3-Mar	25	Faraday's Law		25.3-25.4	
<b>6-Mar</b>	<b>Spring Break</b>				
<b>8-Mar</b>	<b>Spring Break</b>				
<b>10-Mar</b>	<b>Spring Break</b>				
13-Mar	25	EM Waves	HW6	25.5-25.7	(Chapters 24-25)
15-Mar	26	Alternating Currents, Transformers		26.1-26.3	

<b>17-Mar</b>	<b>Exam 2</b>	<b>Chapters 19-22</b>			
20-Mar	26	Oscillation Circuits	HW7	26.4-26.7	(Chapters 25-26)
22-Mar	17	Wave optics		17.1-17.2	
24-Mar	17	Gratings and thin films		17.3-17.4	
27-Mar	17	Single-slit diffraction	HW8	17.5	(Chapter 17)
29-Mar	18	Geometric optics		18.1-18.3	
31-Mar	18	Image formation, thin lenses		18.4-18.5	
3-Apr	18	Spherical Mirrors	HW9	18.6-18.7	(Chapter 18)
5-Apr	19	Cameras, human eyes		19.1-19.3	
7-Apr	19	Microscopes		19.4	
10-Apr	27	Special Relativity		27.1-27.4	
<b>12-Apr</b>	<b>Exam 3</b>	<b>Chapters 23-26</b>			
<b>14-Apr</b>	<b>Good Friday</b>				
17-Apr	27	Consequences of Spec. Rel.		27.4-27.7	
19-Apr	28	Photoelectric effect		28.1-28.3	
21-Apr	28	Matter waves, quantization	HW10	28.4-28.8	(Chapters 27-28)
24-Apr		REVIEW			
<b>27-Apr</b>	<b>Final Exam</b>	<b>2:00-5:00</b>			