CALCULUS-BASED INTRODUCTORY PHYSICS II
COURSE 21:750:214
Spring 2024

Course Description
This course will be very different from other science classes you may have had in the past. Discussion and lab are fully integrated with each other with little formal lecturing. Why? Ask yourself: Can you learn to play tennis by only watching somebody else play?

No?

Then why would physics be any different? Just like tennis, the best way to learn physics is by doing and practicing physics. In my class you will have the opportunity to do what research physicists do, engaging with the practices of physics to learn about the world around you. There is a lot of hard work involved, both inside the class and outside of class time.

And you are expected to do all the work. Everyone who is willing to learn and put in the effort to work on all aspects of the class can succeed here.

Course Goals
In this course you will:

1. Learn to apply the fundamental models of physics to answer questions and solve problems.
2. Develop an understanding of the process by which physics knowledge is invented.
3. Learn to use various representations, words, and mathematics to explain your understanding of physical phenomena and processes.
4. Work collaboratively with your classmates to develop new ideas and solve problems.

Scope
Physics topics we will learn in this course include:

1. Universal gravitation
2. Electrostatics
3. DC circuits
4. Electromagnetism
5. Vibrational Motion
6. Waves
7. Geometric Optics
8. Models of light

Course Website
https://rutgers.instructure.com/courses/249890

Instructor
Joshua Rutberg (jr1316@rutgers.edu)
**Required Materials**

The textbook for this course is


Note: We will be using the second edition of the textbook. An electronic version of the textbook is available through the ACCESS PEARSON link on Canvas.

**Class Times**

Class meets Mondays, Thursdays, and Fridays from 1:00 – 2:20 in Smith 104.

**Assessment and Grading**

The way this class is graded is somewhat unusual, so please take time to familiarize yourself with the system. WE DO NOT USE AVERAGES IN THIS CLASS. You will earn points from everything you do in the class, and your final grade will be determined by the number of points you accumulate through the semester. There are a maximum of 206 points available to you.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Minimum Points Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>185</td>
</tr>
<tr>
<td>B+</td>
<td>175</td>
</tr>
<tr>
<td>B</td>
<td>163</td>
</tr>
<tr>
<td>C+</td>
<td>153</td>
</tr>
<tr>
<td>C</td>
<td>144</td>
</tr>
<tr>
<td>D</td>
<td>123</td>
</tr>
</tbody>
</table>

The breakdown of assignments and grades is given in the table below.

<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>Description/Grading</th>
<th>Can it be redone?</th>
<th>Points per Item</th>
<th>Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>14</td>
<td>4 written questions per week, graded pass/fail. 1 point for each passed question</td>
<td>Yes, unlimited attempts until the end of the current module, then no more.</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Exams</td>
<td>4</td>
<td>2 questions, graded pass/fail. Each question worth 5 points</td>
<td>Yes, 2 attempts during office hours</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Group Exams</td>
<td>4</td>
<td>Solve a hands-on problem or investigate an advanced topic together as a group</td>
<td>No. Each group hands in a write-up and group members get the same grade</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Final Exam</td>
<td>1</td>
<td>4 questions, each worth 8 points</td>
<td>No, final means final</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Weekly Journal</td>
<td>14</td>
<td>Respond adequately to reflection questions and prompts</td>
<td>Yes, one redo if the first attempt is not adequate</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Weekly Quiz</td>
<td>14</td>
<td>Multiple choice/multiple response questions through Canvas</td>
<td>Yes, 2 attempts. Grade based on results of second attempt</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>206</td>
</tr>
</tbody>
</table>

**Homework**

You will receive 4 homework problems each week, spread across each class meeting. Questions will be added to the weekly homework assignments on Canvas as they are assigned. The homework is broken up this way to
encourage you to work a little bit at a time, practicing with the new content we learn each class instead of saving all of your work for the weekend. Your answers to the homework problems can be hand-written or typed, and must be brought with you to the beginning of class when it is due. We will begin each class with a discussion of the homework so it is important that do your work on time.

Each question in the homework will be graded as pass/not passed yet. Each question you pass earns you 1 point. Just like exam questions, each question will test a set of scientific reasoning abilities and physics content goals which will be clearly labeled on the question. You must show adequate evidence of competence on each of the scientific abilities listed for that question in order to pass. If you don't adequately meet all the listed criteria, your attempt is marked "not passed yet."

If you want to achieve a pass on homework question(s) you have yet to pass, you may redo and resubmit the question(s). the redone questions must be shown to your instructor either after class or during office hours before the end of the current module. Within that time frame, you get as many tries as you like to redo your work and improve your homework grade.

Very Important: Any question that you redo must be redone from scratch. That is, the new solution should be completely rewritten on a separate piece of paper.

**Exams**

You will take 4 individual exams through the semester, one for each module of the course. You should refer to the schedule to see when these will take place. Each exam will consist of 2 questions. Each question will test a set of scientific reasoning abilities and physics content standards that will be clearly labeled on the question. Every question will be graded as pass/not passed yet. You must show adequate evidence of competence on each of the scientific abilities listed for that question. If you don't adequately meet all the listed criteria, your attempt is marked "not passed yet." Each question you pass gives 5 points to your overall class grade. You may made two additional attempts to pass exam questions you haven't passed yet. These two attempts will happen during a help session in the following way:

BEFORE you schedule a redo, you need to re-work your previous attempt and convince me that you understand the physics. You must discuss this with me either after class or during a help session.

If I'm satisfied you really understand the material, you will be allowed to schedule a time to take the second attempt. The second attempt will be a new question which assesses the same scientific abilities as the original question.

You can repeat this process twice for any exam question.
**Oral Restitution:** If you achieve a pass on all but one of the rubric items for a particular question, you may demonstrate verbally to me that you understand what you did wrong and how to do it correctly. This will take place during help sessions. If you convince me that you understand what you did wrong or what you missed and how to fix it, your grade will be changed to a "pass." In participating in this, you agree to abide by my final decision.

**Group Exams**
There will be four group exams, one per module. The primary goal of the group exam is either to challenge you to solve practical real-world problems as a group. Group exams will consist of a substantial project that will span a week. Some time will be given for you to work on these group exams during class, but you will be expected to work on it outside of class in order to complete it. Most group exams will have an experimental component which requires you to collect and analyze real data, which can be done in class or at home. At the end of the group exam your group will hand in a a single write-up (typed, submitted via Canvas). All members of the group will receive the same grade. You may cooperate with anyone in the class and may use any resources at your disposal (books, the internet, etc.) to complete the group exam. However, you may not share data with other groups. The point of the group exams is to demonstrate your ability to USE physics in real life.

**Final Exam**
There will be a final exam held during finals week, as per the University calendar. This exam will consist of 4 questions, one from each module. These questions will be similar to the homework and exam questions, and will be worth 8 points. Because you can only attempt the final exam once, questions will not be scored pass/not passed yet like exams and homework and will instead be scored based on the quality of your answers (partial credit will be awarded).

**Weekly Journal**
The purpose of the weekly journal is two-fold:

It allows you to reflect on what you have learned every week, your learning process, and ask questions about thinks you didn't understand in a more private setting (if you are struggling with anything in the course, question 2 is where you get to ask me. I will respond to you directly or devise an in-class activity to review a difficult concept).

It allows me to gauge your learning process and adjust classroom activities and discussions accordingly. For example, if it becomes clear that the majority of the class have not understood a critical idea from the previous week, I will devote more class time to review and discuss it.

**How it works:** Every week you will write a journal on your learning for the week by answers the prompts I pose. Sometimes there will be three questions, sometimes there will be more. There may be a short reading or a video to watch
and reflect on. The journal is submitted through Canvas. Journals are due every week by midnight on Friday. Each journal entry may be redone once if I find your original submission unsatisfactory. This redo is due by midnight on Sunday night. Check Canvas before Sunday night to see if your journal was returned with comments so you can resubmit.

**Grading:** Weekly journals are worth 1 point and graded pass/fail. You will pass long as you are diligent and respond to the prompts. Remember, the weekly journal helps you keep track of your own learning and helps me plan class activities for the week, so I need to your previous week's journal before the start of the next week.

**Weekly Quizzes**

Every week you will need to take a short quiz on the material and ideas we're learning. The quiz will consist of multiple choice and multiple response questions, administered through Canvas. Most quizzes will have an associated reading indicated (from the textbook), that you should use as a resource to help you learn. Quizzes are intended as a way for you to gauge your understanding and to take action if you find that you are NOT understanding some ideas, concept, or technique. That is why you get two tries at every quiz. Between the first and second tries, you should use the resources on offer: First, read the textbook. Second, ask your peers for help. Third, come to help sessions and talk to me. I really want you to use the quizzes as a way to enhance your learning by using them to monitor your understanding and take action if you discover gaps in your learning.

**Attendance, Participation, & Class Protocol (AKA How to get an ‘A’)**

- **Class attendance is mandatory.** The idea behind this course is that, by engaging in the practices of physics, you will construct scientific ideas for yourself. The emphasis is on the process. This means that you cannot miss a day and simply look up the material online or in the textbook. You need to be actively engaged in the inquiry process. Typically, the students who get A's in my course are the ones who use their time productive.
- During class they put their cellphones away, minimize other distractions, and immediately get to work on the assigned activities without waiting for the instructor to tell them to.
- Both inside and outside of class they try to figure things out for themselves (even though they may initially be confused) BEFORE asking for help. Even if you are not able to figure things out on your own this way, the process of having tried makes things easier and more effective when you do come for help.
- Both inside and outside of class, talk with each other, and the instructor, resolving difficulties and things that are unclear.
- Study regularly and effectively rather than "cramming" only before exams. How much total time you spend studying does not matter if you are using this time ineffectively. Shorter, more frequent review sessions will help you retain information better. Your brain naturally forgets information over time,
but the more often you review the slower this process will occur. In psychology, we represent this with the "forgetting curve" shown below.

- Work smarter, not harder or longer. If you have been staring at an assignment for an hour without making any progress, set it aside for a while. Either come back to it later with fresh eyes or talk to someone about it.
- My office hours are for you. Take advantage of them. You can come to ask questions, or to work on your homework.
- Most importantly: They set aside regular hours every week to work on physics outside of class time and hand in their assignments. My course is designed around small but regular assignments. You cannot put off doing this work until the end of the semester. You WILL fail the course if you do that.

**Rutgers Academic Integrity Policy**

Academic Integrity: As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Academic integrity is essential to the success of the University’s educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community.

- Academic Integrity Policy:
  
  [http://academicintegrity.rutgers.edu/academicintegrity-policy/](http://academicintegrity.rutgers.edu/academicintegrity-policy/)

**Disability Services**

Rutgers University welcomes students with disabilities into all of the University’s educational programs. In order to receive consideration for reasonable accommodations, you must complete and submit the Registration Form, schedule and complete an intake meeting, and submit appropriate documentation. If your request for reasonable accommodations is approved, you will receive a Letter of Accommodations (LOA), which you should present privately to the instructor as early in the semester as possible.

Accommodations are not retroactive and are effective only upon submission of the LOA to the instructor. Please begin the process by completing and submitting the Registration Form, Applying for Services, available at the website below.

- Applying for Services:
  [https://ods.rutgers.edu/students/applying-forservices](https://ods.rutgers.edu/students/applying-forservices)
- Documentation Guidelines:
  [https://ods.rutgers.edu/students/documentationguidelines](https://ods.rutgers.edu/students/documentationguidelines)
- Letter of Accommodations (LOA):
  [https://ods.rutgers.edu/myaccommodations/letter-of-accommodations](https://ods.rutgers.edu/myaccommodations/letter-of-accommodations)
Office of Disability Services (ODS) Suite 219, Paul Robeson Campus Center
(973) 353-5315 odsnewark@rutgers.edu

Religious Holiday Policy
Students are advised to provide timely notification to instructors about necessary absences for religious observances and are responsible for making up the work or exams according to an agreed-upon schedule.

Counseling Services
Counseling Center Room 101, Blumenthal Hall, (973) 353-5805 or http://counseling.newark.rutgers.edu.

Students with Temporary Conditions/Injuries
Students experiencing a temporary condition or injury that is adversely affecting their ability to fully participate in their courses should submit a request for assistance at:
https://temporaryconditions.rutgers.edu.

Students Who are Pregnant
The Office of Title IX and ADA Compliance is available to assist students with any concerns or potential accommodations related to pregnancy: (973) 353-1906 or TitleIX@newark.rutgers.edu.

Gender or Sex-Based Discrimination or Harassment
Students experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, should know that help and support are available. To report an incident, contact the Office of Title IX and ADA Compliance:

• (973) 353-1906 or TitleIX@newark.rutgers.edu.
• To submit an incident report: http://tinyurl.com/RUNReportingForm.
• To speak with a staff member who is confidential and does NOT have a reporting responsibility, contact the Office for Violence Prevention and Victim Assistance: (973) 353-1918 or run.vpva@rutgers.edu.