Instructor:

Dr. Peter Pella – Masters 107 – x6025 – pellap@gettysburg.edu

Required Course Materials:

2) Pocket calculator with trigonometric functions, scientific notation, and exponential functions
3) **A green or purple ink pen**
4) A quadrille-lined non-spiral notebook (National model 43-475 in the college bookstore) you may use your lab book from last semester if you had one, and there is enough space left for this semester. Contact your lab instructor from last semester if you need to obtain your old lab book.

Time and Location:

The course meets on MWF in Room 208 in Masters Hall promptly at 10:00 am (Section A) and 11 am (Section B).

Office Hours:

If I am not in class or at a meeting, I will always have time to talk with you about the course, homework, your paper, or any other topic. I especially encourage you to ask for assistance on homework assignments, if you need it. Because of scheduling issues, your most likely to find me Monday, Wednesday, or Friday afternoons. If you would rather schedule an appointment, call or e-mail me (pellap@gettysburg.edu), or the Department's Secretary, Kristi Waybright (ext. 6020; kwaybrig@gettysburg.edu). Franz Utermohlen (uterfr01@gettysburg.edu) and Alana Allen (alleal02@gettysburg.edu) will be the Peer Science Mentors (PSMs) for this course who will be available for scheduled homework and exam help sessions. More information will follow.

Course Overview:

Physics 104 is the second semester of a two-semester sequence in introductory physics (Physics 103/104). This sequence is aimed primarily at students in the health sciences and biology but it is appropriate for most undergraduates. We will explore a wide range of topics this semester including waves, electricity, magnetism, light, optics, radiation, and even some nuclear physics. This is a non-calculus based physics course, which means a strong working knowledge of algebra, and basic trigonometry is required to succeed without extraordinary frustration. The tools learned in Physics 103 (vectors, kinematic equations of motion, conservation of energy, work, etc.) are also essential and required for our analysis of electricity and magnetism and will not be covered formally in this class. If you are coming into this
second semester without these skills it is your responsibility to review the appropriate chapters
to catch up.

**Learning Objectives:**

The primary goal of this class (aside from introducing you to the language of physics) is to
 teach you problem-solving skills. Problem solving requires the ability to initially approach a
 problem (i.e. set the problem up), to think critically about the problem (i.e. know the form of
 the answer), and finally to have the adequate tools to answer the question that has been posed
 (i.e. recognize appropriate physical relationships, a.k.a. equations, and have the math skills to
 actually finish the problem.) The lab component of this class provides an opportunity to
 synthesize the physical concepts that the text covers while reinforcing proper data analysis. All
 the learning objectives are summarized below.

1. The ability to learn to think critically, logically, and analytically when solving quantitative
   problems.
2. The ability to understand broader conceptual issues associated with the physical
   phenomena studied in this class.
3. Knowledge of the historical development of the physics covered in this class to include the
   important persons involved.
4. Knowledge of technical applications of the physics in such things as eye glasses,
   capacitors, motors and generators, nuclear reactors, and nuclear weapons and be able to
   write clearly about them.
5. Finally develop an appreciation of how physicists investigate physical phenomena in the
   laboratory.

**Necessary Math Skills:**

As stated above algebra, trigonometry, and vector addition are used frequently in Physics 104.
In general, you should be able to solve:

- Linear equations in one variable \( 5x – 10 = 0 \)
- Quadratic equations such as \( x^2 + x – 2 = 0 \)
- Two (or more) equations with two (or more) unknowns:
  \[ 5x – 3y – 1 = 0 \quad \text{and} \quad 2x + y – 7 = 0 \]
- Basic trigonometric functions, Pythagorean theorem, etc … *a general math review exists
  in Appendix A of your textbook, please look at it!*

**Class Conduct:**

Class lectures and demonstrations will be used to clarify concepts and problem solving methods
introduced in the text. The lectures cannot always introduce you to the material for the first time,
which means you are expected to read the text before coming to class. We will also spend some
class time on conceptual problems using “clickers” to help with your qualitative understanding
as well. If you have not read the material before class, these conceptual problems will be of little
help to you. Also, conceptual problems will be a part of each exam including the final exam.
Assessment:

Your final grade will be based on a short paper (10%), homework (10%), the lab component (20%), in-class exams (40%) and a comprehensive final exam (20%). Each element of the grading will be discussed below.

Paper:

You will be required to write a short (3 to 5 page) paper expanding upon one of the applications sections of the text or an approved topic of your choosing. It should be well written, well documented (at least two references other than the text), factually correct, and contain no grammatical or spelling errors. The honor code will be strictly enforced. I will be happy to suggest topics for you at any time. You must select a topic by April 21st and submit the paper on the final day of class as denoted in the course schedule.

Homework:

Due dates for homework assignments are given in the course outline. Homework (HW) is assigned as we begin each new chapter. You should be working through a few HW problems every day (do NOT wait for me to show you how to do a problem, work ahead of me). Note also that late homework will not be accepted. If you cannot attend class on a day when HW is due you should turn in the assignment early or have a friend hand it in for you.

Homework solutions will be posted on Moodle and your graded homework will be returned as soon as possible. Homework problems will be graded on a 10-point scale as to whether they were Complete (3 points), Clear (2 points), Plausible (1 point), Initially OK (1 point), and Correct (3 points). The grading scheme is as follows:

- **Complete**
  - 3 = all parts present and fully developed
  - 2 = some parts incomplete
  - 1 = major sections missing
  - 0 = little meaningful work done

- **Clear**
  - 2 = model (i.e. physical reasoning) was clear to the grader
  - 1 = some aspects were unclear
  - 0 = model was completely opaque

- **Plausible**: One point is awarded if the result's magnitude, sign, and/or units are plausible.

- **Initially OK**: One point is awarded if the solution is acceptable on the first pass.

- **Correct**
  - 3 = no modeling or algebraic errors
  - 2 = some modest errors were made
  - 1 = fundamental errors were made
  - 0 = almost nothing was correct
Most of the time, we will cover the material for the homework problems before they are due. However there will be occasions when you must practice your ability to self-learn. That means you may have to attempt a problem solution based on what you have read in the text. To compensate you for this effort, you will be allowed to self correct some of your homework. You should receive your graded homework papers back from my grader within the next two class days. You will be allowed to submit corrections (in green or purple ink only) to me on the following class. You may earn additional points only for the "Clear" and "Correct" categories: the scores for all other categories remain fixed at their initial values. This implies that you could earn a maximum of 9 points on a complete and plausible but incorrect initial effort after the appropriate correction.

You will be allowed to submit no more than 3 problems on the class following receiving back your graded homework, and you may submit any previously graded problems that you feel were graded unfairly. But a total of only 3 problems per homework set will be accepted. The honor code will be strictly enforced. The PSMs for this course will be available in the student lounge of Masters Hall a couple of evenings a week to help with homework, exam preparation, etc. The exact evenings will be announced during the first week of classes.

There are 96 homework problems assigned this semester. They are worth 10 points each for a total of 960 points. Your homework average will be determined by dividing your total homework points by 930. You will also be able to earn 20 extra homework points every time you attend one of the Physics Department Colloquia held throughout the semester. You will be notified of those dates. Please be sure to sign the attendance sheet at the Colloquium. You will get 5 points for just attending and 15 points for a short written summary of the talk. The summary should contain the title of the talk and the presenter. You should also include (to the best of your ability) what the talk was about, what you learned from the talk and what you liked and/or disliked about the talk. A few sentences or outline should suffice. This will compensate for a poor grade on one assignment or a missing assignment.

If you are unable to attend any of the talks, you may submit a second short (3 to 5 page) paper expanding upon one of the applications sections of the text or an approved topic of your choosing for 60 extra homework points. I will be happy to suggest topics for you at any time. Keep in mind that the highest homework grade will only be 100%. Also remember, I will not accept late homework.

Exams:

There will be 4 in-class exams and a cumulative final. All four in-class exams are weighted equally. Each exam will consist of a few multiple-choice questions or other conceptual questions and standard quantitative problem-solving exercises. The multiple-choice questions will be a mixture of simple single concept calculations, and conceptual or qualitative questions and will be similar to those presented in class using “clickers”. The problems solving exercises will give you the opportunity to display your problem solving skills. The Final Exam will cover material from the whole course with about one quarter of it covering material presented after the fourth in-class exam. All exams are closed note/closed book but equations and physical constants will be provided. In the event that you will miss an exam for a legitimate
reason (see below), please let me know as soon as possible so that we can arrange for you to take the exam early. In some rare circumstances, I may consider a make-up exam; however, it is in your interest to arrange to take the original exam early. My make-up exams will be more challenging than the original.

On exam days, the exams will be placed on the instructor table. Please pick them up as you walk in. Also, please place your book bags, electronic devices, etc at the front of the room. You are only allowed to use a calculator and pen or pencil for the exam. You may start the exam as soon as you arrive.

I will supply all equations and constants that you might need. If fact, the class before the exam I will provide an equation sheet for you, exactly as it will appear on the exam. There will also be some additional problems and answers to help you prepare for the exam. The solutions to these extra problems will also be posted on Moodle.

**Grading Scale:**

All grades in this class will be based on a fixed scale, so that you do not need to compete with each other. If average class performance for any item is particularly low (indicating that the item was unusually difficult) I may adjust grades to be higher than this average would indicate. My letter grades are based on the percentages shown below.

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<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A+</td>
<td>98 or above</td>
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<tr>
<td>A</td>
<td>93-97</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<tr>
<td>B+</td>
<td>87-89</td>
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<td>B</td>
<td>83-86</td>
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<td>B-</td>
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<td>C+</td>
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<td>C</td>
<td>73-76</td>
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<tr>
<td>C-</td>
<td>70-72</td>
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<tr>
<td>D+</td>
<td>67-69</td>
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<tr>
<td>D</td>
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<tr>
<td>D-</td>
<td>60-62</td>
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I will round off to the higher grade in the usual scheme (89.5 = 90).

**Attendance:**

You are ultimately responsible for your education … attendance is expected at all lectures but is not a requirement. As explained above late homework will not be accepted. Missing a homework assignment or exam will result in a score of zero unless you have a written valid excuse. Examples of written valid excuses would be: from the academic dean, the attending physician, the officiating clergyman, the presiding judge, the arresting officer, etc … Simply seeing a physician does not constitute a valid excuse. Some flexibility will be allowed to accommodate unforeseen legitimate crises. I know that a “legitimate crisis” means different
things to different people, please let me know about any absences as soon as possible so that we can make appropriate arrangements. Again, if you know you will be absent on an exam day, please schedule to take the exam earlier.

Honor Code:

Students are expected to fully understand and respect the policies regarding academic misconduct as explained in the Honor Code Booklet. If you are unsure of what constitutes academic misconduct in physics please ask me! Learning physics requires a great deal of active participation. This means interaction with the subject matter via your text, lab activities, problems, your professor, your PLA, and your classmates but … all work handed in must be your own calculations and must include the full Honor Code Pledge and your signature AFTER the work is completed. This holds for your HW, labs, and exams. On the homework, in particular, this means that you may discuss with anyone how a particular problem might be solved but when you sit down to write up your solution and actually do the calculations, you must do them yourself. Copying someone else’s omework solution is a clear violation of the honor code. You must also list whom (besides the PLA and me) you worked with on the assignment. Work handed in without the complete honor code and signature will be handed back ungraded. The full pledge is “I affirm that I have upheld the highest principles of honesty and integrity in my academic work and have not witnessed a violation of the Honor Code.” Students must sign the pledge even if their signature or name appears elsewhere on the paper.

Lab Procedures:

There are 6 laboratory sessions and the lab schedule is contained on the syllabus. Both the Thursday afternoon and Thursday evening labs will be divided into two lab sections A and B. Lab is an integral and important part of the study of physics. You must attend all lab sessions to pass this course. If you have a true emergency or extraordinary legitimate conflict, making your absence in lab unavoidable, you must inform your lab professor as soon as possible. There are options to avoid missed labs in these rare cases but you must communicate with your lab professor well before the lab in question to arrange an alternate plan. Keep in mind that you are not free to attend any lab section. To attend a different lab section requires pre-approval from BOTH lab instructors. Any work done outside of your regularly scheduled lab period must be pre-approved, checked, and signed by your lab professor.

Special Considerations:

Any student in this course who has a disability that may prevent her/him from fully demonstrating his/her academic potential should contact me immediately so that we can discuss accommodations necessary to ensure full participation in this class and facilitate the learning process.
| F 1/24: CH 11: Waves (7-12) | F 3/21: CH 18: Ohm’s Law (1-3) - (HW 6) |
| **M 1/27: CH 11: Resonance (13) - (HW 1)** | **M 3/24: Exam III: Chapters 16-17** |
| **F 1/29: CH 12: Sound (1-2) - **Lab 1: Hooke’s Law Lab Group A**** | **W 3/26: CH 18: Power (4-5) - **Lab 4: Physical Optics Lab Group B**** |
| F 1/31: CH 12: Resonance (4-6) | F 3/28: CH 18: Household Circuits (6-10) |
| **M 2/3: CH 12: Doppler Effect (7) - (HW 2)** | **M 3/31: CH 19: Circuits (1-2)** |
| **W 2/5: Exam I: Chapters 11-12 - **Lab 1: Hooke’s Law Lab Group B**** | **W 4/2: CH 19: Kirchhoff’s Rules (3) - (HW 7) Lab 5: Ohm’s Law Lab Group A** |
| **F 2/7: CH 22: Light (3-4)** | **F 4/4: CH 19: Meters (5-8)** |
| **M 2/10: CH 23: Ray Optics (1-2, 4-6)** | **M 4/7: CH 20: Magnetism (1-2,9)** |
| **W 2/12: CH 23: Mirrors (3) - **Lab 2: Waves on a String Week Lab Group A**** | **W 4/9: CH 21: EMF (1-2,5,7) - (HW 8) - **Lab 5: Ohm’s Law Lab Group B**** |
| **F 2/14: CH 23: Lenses I (7-8)** | **F 4/11: Exam IV: Chapters 18-21** |
| **M 2/17: CH 23: Lenses II (9-10) - (HW 3)** | **M 4/14: CH 27: Early Quantum (1-3)** |
| **W 2/19: CH 24: Interference (1-4) - **Lab 2: Waves on a String Week Lab Group B**** | **W 4/16: CH 27: Bohr Model of the Atom (10-12) - **Lab 6: Parallel Circuits Lab Group A**** |
| **F 2/21: CH 24: Diffraction (5-7)** | **F 4/18: CH 27: Bohr Model II - (HW 9)** |
| **M 2/24: CH 24: Polarization (10) - (HW 4)** | **M 4/21: CH 30: The Nucleus (1-2) **TOPIC DUE**** |
| **W 2/26: Exam II: Chapters 22-24 - **Lab 3: Optics/Image Formation Lab Group A**** | **W 4/23: CH 30: Radioactive Decay I (3-6) - **Lab 6: Parallel Circuits Lab Group B**** |
| **W 3/5: CH 16: Problem Solving (6) - **Lab 3: Optics/Image Formation Lab Group B**** | **W 4/30: CH 31: Nuclear Fusion (3)** |
| **F 3/7: CH 17: Electric Potential (1-3) - (HW 5)** | **F 5/2: Lecture: Reactors and Bombs - (HW 11) **PAPER IS DUE**** |
| **3/10 - 3/14 Spring Break – HAVE FUN!** | **T 5/6 Final Exam SECTION A & B 6:30 pm – 9:30 pm** |
HOMEWORK ASSIGNMENTS:

HW 1 - CH 11; 2,9,14,20,29,41,49,53,54  
Due M 1/27

HW 2 - CH 12; 4,9,26,28,37,47,50,57,88  
Due M 2/3

HW 3 - CH 22; 15,18; CH 23; 4,13,15,31,38,47,53  
Due M 2/17

HW 4 - CH 24; 2,5,15,21,34,62,70  
Due M 2/24

HW 5 - CH 16; 3,4,14,23,29,32,36,41,51  
Due F 3/7

HW 6 - CH 17; 5,12,19,22,23,37,41,44,53  
Due F 3/21

HW 7 – CH 18; 4,9,12,22,33,36,41,47,50  
Due W 4/2

HW 8 – CH 19; 1,11,17,25,29,30,40,49,70  
Due W 4/9

HW 9 – CH 27; 4,11,12,22,23,49,55,60,79  
Due F 4/18

HW 10 – CH 30; 4,12,15,19,23,24,38,49,61  
Due F 4/25

HW 11 – CH 31; 4,5,14,17,18,21,28,69  
Due F 5/2

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<thead>
<tr>
<th>LABS</th>
<th>Dates</th>
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<tbody>
<tr>
<td>1) Hooke’s Law</td>
<td>1/30 &amp; 2/6</td>
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<tr>
<td>2) Waves on a String</td>
<td>2/13 &amp; 2/20</td>
</tr>
<tr>
<td>3) Ray Optics/Image Formation</td>
<td>2/27 &amp; 3/6</td>
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<tr>
<td>4) Physical Optics</td>
<td>3/20 &amp; 3/27</td>
</tr>
<tr>
<td>5) Ohm’s Law</td>
<td>4/3 &amp; 4/10</td>
</tr>
<tr>
<td>6) Parallel Circuits</td>
<td>4/17 &amp; 4/24</td>
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