**What we aim at:**

An enormous number of important problems our society faces are intimately related to Physics. This includes such hot-button topics as energy, global warming, and terrorism. Misjudge the science, make a wrong decision. Yet, many political leaders and concerned citizens have a hard time evaluating the issues, because they have never been taught about the underlying physics. Is radioactivity good or bad? What is it in the first place? Why don’t we have more battery-run cars? What actually is a battery? Could we run cars on solar cells, if we just build really really good solar cells? None of these questions are stupid, all of them involve physics, and their answers might change our views or how we would argue for our standpoint.

The aim of this course is to provide you with some of the essential facts and pieces of physics underlying such questions. A view of the world that includes a basic understanding of science and technology is a richer (and more satisfying) one. Knowledge is a better guide to judgment than opinions based on misunderstanding. This course will enable you to grasp many of the issues that dominate today’s political discourse and to develop an informed opinion (*your*, not our!) for which you can rationally and quantitatively argue.

**How we proceed:**

This course is not “Physics for Dummies”. You will learn about interesting and important topics that even a typical physics major will not know. The material will be advanced, and it will require focused attention on your part, but it will *not* be difficult because the math is hard. We will basically skip the math. The aim of this course is not to enable you to do a detailed computation; you could always hire a physicist to do that, but you’d need a basis to judge under which circumstances it’d be important to know an accurate answer (and whether you’d believe it in the end). To master this skill you need to know some key facts, understand some fundamental concepts, and be able to come up with order of magnitude estimates by combining the two. Hence you need to become comfortable with the use of large numbers, a skill we will practice a lot. It matters whether you’re talking about a million or a billion or a trillion – those are *not* just three very large numbers.

We will not proceed in the classical way a physics course is taught: Spelling out definitions, discovering laws, studying idealized model cases, etc. We jump right into the topic, at the danger of not being precise the first time, and refine our understanding later, as we learn more.
What we will cover:
Being more motivated by critical current issues than by traditional physics sub-disciplines, we will cover a wide spectrum of physics topics, more than you’re likely to meet in any other course. It will be held together by its relevance to comprehend central themes (such as energy efficiency, climate change, nuclear weapons, and nuclear energy), not by the desire to construct internally consistent and logically complete constructs of ideas. Among the topics we’ll plan to treat are:

- Energy and Power
- Atoms and Heat
- Gravity, Forces, Space
- Radioactivity
- Chain Reactions, Nuclear Power Plants and Bombs
- Electricity and Magnetism
- Waves
- Light (visible and invisible)
- Student Choice (the class will select a topic for the final two weeks)

Moral:
If you believe this is a cheap way to tick off on a science requirement, this course is not for you. But if you want to seriously make an effort and learn the material that will enable you to judge for yourself, what all the real and would-be experts are talking about (and whether they know they’re talking about), welcome to 33-115.

In Class
Full-class lecture/discussions are MWF. Small-group recitation sections are held on Thursdays. The lectures will introduce new material and highlight important concepts. You will be responsible for all the material specified in the weekly course schedule, which may include material not be covered in lecture. Your recitation instructor will help you by reviewing the material and discussing a limited number of assigned problems. However, physics skills and knowledge cannot be developed by passive listening. The majority of your recitation time will be spent either working in groups or participating in discussions.

In-class activities and responsibilities:

- You are responsible for attending all classes and attendance will count toward your grade.
- Bring the textbook to your recitation classes.
- MWF classes will usually be devoted to lectures, discussions, and demonstrations.
- The Thursday recitations will usually be devoted to discussions.
- If you miss class, it is your responsibility to find out what you missed. Handouts will normally be posted to the course website.
**Outside Class**

Weekly details and assignments will be found on the website. You are responsible for the following outside class:

- Read the assignments carefully, study the assigned textbook sections, and turn in assigned problems
- Homework must include complete, legible explanations of your work.
- **Important:** This is a 10 unit course. Expect to spend about **6 hours per week outside of class** studying for this course.

**Homework Problems**

Homework problems will be graded and will count toward the final course grade. Homework is due at the start of the specified class; it may receive half-credit if handed in by the start of class on the following day; it may not be graded at all if handed in later without a valid excuse. Homework must be legible, clearly organized, and stapled (if multiple pages), so that we can easily follow your reasoning, or it will be returned ungraded.

**Concept Tests and Classroom Response Clickers**

Concepts Tests are short questions given during lecture. They are usually conceptual in nature. This teaching methodology has been proven to be beneficial in large lecture classes. It will give you a chance to think about new material as it is introduced and break up the 50 minute lectures. The instructor will discuss the solutions as part of the lecture. In some cases, you will be allowed to discuss the questions with your fellow students before answering.

We will be using a *iClicker Response System* that allows interactive. All students must purchase a device called a "clicker" at the start of the semester. This device, which looks like a small TV remote controller will communicate your answers to a classroom receiver. Your individual response will remain confidential, but the class and instructor will be able to view the percentage of students who give the correct answer and the lecture discussions will be guided by the results. On designated competition days, we will also be using the iClicker system to determine the top team and individual scores.

The Concept Test grading is designed to give you credit for participation in lecture without being penalized for wrong answers. You will get full credit for participation in a day's lecture if you get more than 50% of the answers correct. In general, the questions will be designed so that this is easy to achieve. In the event you fail to get 50% correct, you will be notified via Email. You will still get full credit simply by reviewing the concept tests (which will be posted on the web along with the correct answers) and sending the course instructor an email which indicates that you have reviewed the results. This algorithm may be adjusted during the semester to assure that conscientious students receive full credit for participation. The concept tests will remain on the website and will help you in reviewing the material.
Assignments and grading:
The course assignments will include work to be performed both individually and in small groups. Much of the work will involve short essays. Some assignments will require you to utilize current newspapers and technical magazines in addition to web-based resources. There will be two mid-term exams and a final exam.

Grades
The final grades will be determined on the following basis:

- 30% Final Exam over the whole course
- 30% Two hour exams
- 25% Assignments
- 10% Quizzes
- 5% Attendance and participation

Grades are based on an absolute basis: A 89-100%, B 75-88%, C 60-74%, D 50-59%, R 0-49%. There is no grading on the curve (grade as rank in class). The grade boundaries will not be raised but they may be lowered by the instructor. If the entire class earns 89% or above, the entire class will receive an A. While this is not likely to happen, note that helping your fellow students will not harm your own grade. We are all on the same team.

Collaborative Work
Scientists and engineers normally work in groups, and social interactions are critical to their work. Most good ideas grow out of discussions with colleagues. In this course, we want you to work with others as much as possible. Study together, help your partners to get over confusions, ask each other questions, and critique each others’ homework write-ups. Teach each other! You can learn a great deal by teaching. But do turn in your own assignments. While collaboration is the rule in technical work, evaluations of individuals also play an important role in science and engineering. Exams and quizzes are to be done without help from others. Cheating will be heavily penalized in accord with university regulations noted below.

Help
You should ask lots of questions in class. If you fall behind for any reason, please let us know as soon as possible. The sooner we know about these situations, the better we can help you make up work. We will do what we can to help you complete the course satisfactorily, but an incomplete grade cannot be given simply because you fell behind. Ask your TA for help if needed. Don’t worry that others will know you don't know; most probably, they don't know either.
University Policy on Cheating and Plagiarism

Students at Carnegie Mellon are engaged in preparation for professional activity of the highest standards. Each profession constrains its members with both ethical responsibilities and disciplinary limits. To assure the validity of the learning experience a university establishes clear standards for student work.

In any presentation, creative, artistic, or research, it is the ethical responsibility of each student to identify the conceptual sources of the work submitted. Failure to do so is dishonest and is the basis for a charge of cheating or plagiarism, which is subject to disciplinary action.

**Cheating** includes but is not necessarily limited to:

1. Plagiarism, explained below.
2. Submission of work that is not the student's own for papers, assignments or exams.
3. Submission or use of falsified data.
4. Theft of or unauthorized access to an exam.
5. Use of an alternate, stand-in or proxy during an examination.
6. Use of unauthorized material including textbooks, notes or computer programs in the preparation of an assignment or during an examination.
7. Supplying or communicating in any way unauthorized information to another student for the preparation of an assignment or during an examination.
8. Collaboration in the preparation of an assignment. Unless specifically permitted or required by the instructor, collaboration will usually be viewed by the university as cheating. Each student, therefore, is responsible for understanding the policies of the department offering any course as they refer to the amount of help and collaboration permitted in preparation of assignments.
9. Submission of the same work for credit in two courses without obtaining the permission of the instructors beforehand.

**Plagiarism** includes, but is not limited to, failure to indicate the source with quotation marks or footnotes where appropriate if any of the following are reproduced in the work submitted by a student:

1. A phrase, written or musical.
2. A graphic element.
3. A proof.
4. Specific language.
5. An idea derived from the work, published or unpublished, of another person.