PHYS 155: The Physics Behind the Internet (Spring 2009); Course reference number: 36243; Credits: 4
Schedule: M,W 10:00-11:50, room 16 Pacific Hall

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Office hours: T F 3:00-4:30, and by appointment (best to email first)

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Office hours: M Th 2:00-3:30, and by appointment (best to email first)

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Course home page: Blackboard system, https://blackboard.uoregon.edu/webapps/login/

Course Description: “The Internet is a network of millions of computers capable of exchanging data files containing information. The technology that makes this possible is the result of the efforts of tens of thousands of physicists, engineers, and computer scientists over more than a hundred years. The development of the Internet is an amazing story of the transformation of fundamental physics discoveries into practical systems. This course is a non-science major’s introduction to the physical concepts that explain how information is stored, transmitted, processed, and retrieved. Fundamental issues in physics will be discussed using only elementary math and simple algebra.”

Prerequisites: no formal requirements, but see below.

Required Materials:
Calculator: You will need a scientific calculator for this course, and you should plan to bring it to all classes and exams. It should be able to calculate using scientific notation for large and small numbers. For example the Sharp EL-531WB BK will work if you have a really cheap one, while some TIs’ and HPs will do even more. There are plenty of choices at the UO bookstore.

i>clacker: You need to purchase an i>clacker from the UO bookstore (about $30 new, with good resale value). You will need to register your i>clacker on the web at http://www.iclicker.com/registration/ Use your Blackboard user name, the same as your UO Duck ID name [not your UO ID number], and the ID number printed on the back of your i>clacker, when you register. Contact me immediately if you have problems registering your i>clacker. You will use this to respond to class polls and to take in-class quizzes (see the grades section below). You should bring your i>clacker to every class, and I will expect you to obtain and register one prior to Monday of the second week of classes.

Text: The (required) textbook for this course is The Silicon Web (by Michael G. Raymer, to be published by Taylor and Francis, June 2009). A course packet with the needed chapters of the book will be available at the UO bookstore. It might be possible for some of you to buy used copies of the entire pre-publication draft of the book on craigslist.com from students who took this same course in Winter term. (Offer them $15, half of what they paid.)

We will also post notes for the course (the slides we show in class) on the course Blackboard site. Check the Announcements page for updates on when new notes are posted. In general, these notes will be available after the corresponding material is covered in class; so you should still plan to take your own notes during class (the simple act of writing information down will give you a good head start on learning it).

Use of Math: This is a physics class (not a technology or computer science class). Physics is the discipline of understanding how relatively simple things work. One of the main aspects of physics that makes it an especially precise and useful discipline is that you can use mathematics to understand how things work. For example you know that if you stand at the edge of a canyon, you will hear an echo. Armed with a simple formula and a couple of numbers, you can
predict how long it will take before you hear the echo, if you know how wide the canyon is. Or you can measure how
it takes the echo to come back, and from this determining how wide the canyon is.

As such, you will need to employ some basic math skills—skills you already needed to master to graduate from high
school, like: fractions, simple algebra (solve 2x=5), roots, exponents and scientific notation, how to use a calculator, and
how to draw and interpret graphs. You will do not do well in this class if you don't master math at this level—so make
sure to get help if you need it. This doesn't mean that you have to be a math whiz. We'll review the math concepts needed,
and we won't go anywhere near the kind of math you need in an upper-level physics class. However, if you're math-
phobic, I hope the course can help you learn to be a bit less math-phobic. Why bother with all this annoying math? In
addition to ordinary life tasks, such as figuring out whether or not it's worth it to refinance your mortgage, mastering math
skills develops problem-solving abilities, and your ability to think critically about just about anything.

Grades: Grades for the course will be based on quizzes, homework, two midterm exams, and a final exam, weighted as:

* Quizzes (using i-clickers): 7%
* Polls: 3%
* Homework: 30%
* Midterm exam 1: 15%
* Midterm exam 2: 20%
* Final exam: 25%

Quizzes: Most of the classes will begin with a short reading quiz, where you submit your answers using your clicker.
The point of the quizzes is to add incentive to do your assigned reading before class, and the questions are designed to be
easy if you've done the reading (they won't test mastery of the material). I understand you may need to miss an occasional
class; therefore I will drop your lowest 2 quiz scores, including any missed quizzes and forgot-my-clicker days, in
computing your final grade.

Polls: Classes will involve poll questions which can be answered with your clicker. It doesn't matter whether or not you
get these questions right. You will receive full points if you answer at least two-thirds of the poll questions asked
throughout the term. This is to give you incentive to participate in class. Answering less than two-thirds of the questions
will result in a pro-rated poll score.

Homework: Weekly homework sets will be assigned on the Blackboard site one week before they are due. Homework is
due each Wednesday at the beginning of class (except where noted). I will accept late homework no more than 24 hours
late (10 AM Thursday) [turn it in to me at my office or slide under my office door]. Late homework will have 25%
deducted. We will try to post solutions to each homework assignment within one day after it is due.

Midterm exams: There are two midterm exams, to be held in class on Wednesday Apr 22, and Monday May 18.

Makeup exams (NONE): The exams are pre-scheduled so you can avoid scheduling conflicts. Thus, there will be no
makeup exams for this course, so please check the dates now. If you have a serious and documented reason for missing an
exam (death in the family, serious illness), your final-exam score will count in place of the missed midterm exam score.
That is, your final-exam score will count for double what it would otherwise. Otherwise, you'll receive a zero score
for a missed exam.

Final exam: The final exam will be held from 10:15 am-12:15 pm on Wednesday, June 10. You must take the exam at
this time. (No exceptions.)

Grading scale: The expected grading scale for this course is: 100-90 = A, 89.9-80 = B, 79.9-70 = C, 69.9-50 = D, <50 :
in danger of F. If the final class average is excessively low, I may apply a curve for a higher average final grade.

However, you are guaranteed at least the grade listed below based on your course average.

Pass/fail grading option: A passing grade requires at least the equivalent of a C- grade.
Responsibilities in this Class: Physics is not a spectator sport. It is an often challenging discipline that requires active engagement on your part—both in and out of the classroom.

Reading: We will take an active approach to learning in this class, and this does not include me reading the book to you in class. You need to read the assigned material before each class. This is crucial to your getting any benefit from attending class. You wouldn't show up to a literature class without reading the novel to discuss beforehand, and this class is no different. To credit you for reading the material in advance, we will have brief, easy (if you did the reading) clicker quizzes at the start of most classes. In class, we won't necessarily cover everything that's in the assigned reading—while the exams will concentrate mostly on topics we emphasize in class, anything from the assigned reading is fair game for an exam question. In class, we will review the more difficult and important concepts, answer any questions you have, show you demonstrations to illustrate the concepts and help you build a mental model for understanding physics, and encourage your participation and help you learn by doing clicker quizzes.

Participation: As an active learner, you will obviously need to participate regularly in class. The main way to participate will be in the form of answering “clicker questions,” where the whole class will answer a multiple-choice question designed to uncover common misconceptions about physics, and then we will discuss the question after seeing what the answers are. Remember, you get credit just for answering the poll questions (even incorrectly). Your responses are known only to you and the Instructors. Also, if you do give a wrong answer, this is in some sense good: this means you have the chance to learn something! I don't expect you to have mastered the material by the time we discuss it in class. But of course, you should master it by exam time!

I will also be thrilled if you ask questions in class or during office hours. This tells me you're actually making an effort to learn something. Assuming the in-class questions are actually related to physics and the internet, just interrupt me anytime. Also, feel free to email me before class if you find something in the reading especially confusing. This helps me know what you want to spend class time understanding, and I'd be happy to adjust my lectures, demonstrations, etc. appropriately.

Attendance: You will need to show up promptly at the beginning of each class to take and get credit for each quiz, and to participate in class. Some of your lowest scores are dropped, as mentioned above, in computing your final grade, so this allows you to miss a few classes without penalty if necessary. I won't distinguish between excused and unexcused absences. I have pre-scheduled the exams so you can plan around them; there are no make-up exams for this course.

Syllabus—schedule of topics we will cover in this course, with reading assignments for you to complete before each class. Reading Assignments are for Reading in ADVANCE of each class. (Except that for the first class.)

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<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
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<tr>
<td>Mar 30</td>
<td>Apr 1</td>
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<tr>
<td>Introduction, Science and Math</td>
<td>Speed, Acceleration, and Force</td>
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<tr>
<td>Graphs; Scientific Notation</td>
<td>Reading: Sections 3.1-3.2 (pp. 3-1 to 3-13)</td>
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<tr>
<td>Reading: Chapter 1 (pp. 1-1 to 1-18)</td>
<td>Newton's Laws and Energy</td>
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<td>Sections 2.1-2.5 (pp. 2-1 to 2-9)</td>
<td>Reading: Section 3.3 (pp. 3-14 to 3-20)</td>
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<td>Apr 6</td>
<td>Apr 8</td>
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<tr>
<td>Thermal Energy and Power</td>
<td>Electric Charge and Electric Fields</td>
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<tr>
<td>Reading: Section 3.4-3.9 (pp. 3-20 to 3-36)</td>
<td>Reading: Sections 5.1-5.4 (pp. 5-1 to 5-14)</td>
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<td>Homework 1 due</td>
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<td>Date</td>
<td>Topic</td>
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<td>Apr 13</td>
<td>Current and Energy</td>
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<td>Apr 15</td>
<td>Magnetism and Electromagnetism</td>
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<td>Apr 20</td>
<td>Electric and Magnetic Induction (continued)</td>
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<td>Apr 22</td>
<td>Exam 1</td>
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<td>Apr 27</td>
<td>Harmonic Motion</td>
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<td>Apr 29</td>
<td>Wave Interference</td>
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<td>May 4</td>
<td>Radio Waves</td>
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<td>May 6</td>
<td>Analog and Digital Radio</td>
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<td>May 13</td>
<td>Lasers</td>
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<td>May 18</td>
<td>Exam 2</td>
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<td>May 20</td>
<td>Quantum Description of Lasers</td>
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<td>May 25</td>
<td>-- No Class: Memorial Day</td>
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<td>May 27</td>
<td>Optical Communication: Lasers, Multiplexing, and Routing</td>
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<td>June 1</td>
<td>Communication Networks and the Internet</td>
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<td>June 10</td>
<td>FINAL EXAM 10:15 AM – 12:15</td>
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Other important dates:
- Last day to drop classes without a “W”: Apr 6
- Last day to add/drop classes: Apr 8
- Last day to withdraw from classes: May 25