



## Course Syllabus



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## Physics 135 Course Syllabus, Fall 2012

### Class Meeting Times

**Section 1 (CRN 42196)** Monday and Wednesday: 1:25 - 3:20; Friday: 1:25 - 2:15

**Section 4 (CRN 42199)** Monday and Wednesday: 3:35 - 5:30; Friday: 3:35 - 4:25

**Class Meeting Location:** Nielsen Physics Building, Room 207

### People

Dr. Stuart Elston, Instructor

Office Hours: MWF 10:00 - 11:30, or by appointment.

Office: 216 Nielsen Physics Building

Phone: 974-7818

email: selston@utk.edu --- **BUT** if it's about an assignment, please use WebAssign's *Ask Your Teacher* or *Extension Request* at the end of the assignment.

Graduate Teaching Assistant(s): TBA

Undergraduate Assistant(s): TBA

### Catalog Description

***Introduction to Physics for Physical Science Majors and Mathematics Majors I (4)***

Calculus-based physics of mechanics and waves. (NS)

Contact hour distribution: 3 hours lecture and 2 hours lab.

(RE) Corequisite(s): Mathematics 141

Comment(s): Alternative to Physics 137 for physics majors.

### Detailed Course Description

#### Content

This is a four credit-hour, calculus-based physics course covering basic mechanics and some of what has come to be called "modern" physics. The emphasis in this course is that a very wide range of behaviors, from the orbital motion of a star about a galactic center to the vibration of atoms in a solid, can be described starting with a small number of fundamental principles. Using these powerful principles, models can be constructed to explain a wide variety of physical phenomena. Topics covered in the first semester include the description of motion (kinematics),

the causes of motion (forces and dynamics), conservation laws (momentum, energy, and angular momentum), motion of extended systems (rotation, vibration), gravitation, and mechanical waves and microscopic aspects of thermodynamics. This amounts to most of Chapters 1 through 13 of the textbook listed below.

### Goals

By the end of the semester, you should be able to:

- Apply a small set of fundamental physical principles to a wide variety of physical situations.
- Use these principles to explain a wide variety of behavior on both microscopic and macroscopic scales.
- Use these principles to quantitatively predict the behavior of these systems.
- Model complex physical systems by making approximations and idealizations in order to construct a simple physical model that applies fundamental principles.
- Translate a physical model into a 3D animated computer model of the physical situation.

***Our approach to teaching introductory physics is very different from the traditional lecture-based course*** (with laboratory). ***As a result, it is very important that you read this syllabus thoroughly***, so that there are a minimum of surprises; understanding a little about the process will help you succeed in this environment. You should notice from the very first day that this is not your mother's or father's college physics course.

### Learning Environment

This course will emphasize rigorous problem-solving in physics using interactive instruction, educational software, computer applications important for students of science and engineering, and cooperative learning (sometimes called peer instruction).

Each class meeting will require students to be responsive, to think, and to perform hands-on tasks. (Get a good night's sleep before coming to class!) While key concepts of new material will often be discussed in short lectures, you are responsible for all of the readings outlined in the course schedule/calendar, regardless of whether it is discussed in class. Specifically, you will be responsible for learning definitions from readings, and for asking questions through the course forum, by email, or in person when you want a topic discussed more deeply in class. There will be no discrete lecture periods and lab periods --- lecture/discussion, lab work, and other hands-on activities will occur when and as appropriate to foster engagement in the course material.

### Collaborative Work

Scientists and engineers work in groups as well as alone. Social interactions are critical to their success. Most good ideas grow out of discussions with colleagues. Research has shown that most people learn physics best from, and by working with, their peers, not from long lectures and cookie-cutter labs.

You will be assigned to work in a group for most of your class work. As you study together, help your partners with things that you understand but confuse them. Ask each other questions, and critique group homework and lab write-ups. Teach each other. There is an old saying, that "the best way to learn a subject is to (force yourself to) teach it." There is a lot to be said in favor of this piece of folk wisdom.

As the semester progresses, you should notice that the instructional team (instructor and graduate and undergraduate assistants) develops into a collaborative group as well, creating and implementing activities to help you learn. We believe so strongly in collaborative work that we are willing to run the class with that instructional model in mind!

Of course, while collaboration is the rule in technical work, evaluations of individuals also play an important role in science and engineering. Tests and exams are to be done without help from others. To ensure that you are prepared for individual assessments, it is absolutely critical that you play an active role in the group work, and not passively let your teammates do the work for you.

## Course Requirements

### Pre- and Corequisites

It is very important that you have a good, working grasp of mathematics at the pre-calculus level and that you either have taken the equivalent of Mathematics 141 or 147, or are taking one of these courses in parallel with this course. It is absolutely critical to be able to apply trigonometry to two- and three-dimensional physical situations, and we will start with examples that will give you a chance to practice trig. We will quickly progress to using simple derivatives in our description of motion, so the material in this course should help to reinforce the practical aspects of the calculus you have learned or are learning, but the fancy detail that makes mathematics professors happy will not get much attention here.

No prior experience with computer programming is required. We will teach you everything you need to know for the computer modeling that is a component of the course.

### Attendance and study requirements

Class meets 5 "hours" (50-minute "hours") per week. Attendance (**both physical and mental**) is **required**. In addition to 5 in-class hours weekly, you should expect to spend about 8 hours per week studying outside class. If you typically spend much less than 8 hours weekly of outside study, you are unlikely to be able to learn the material. If you find yourself spending much more than 12 hours weekly on outside study, you should consult with the instructor about ways to study more efficiently.

It is very important to keep up with the class. Make sure you read the assigned material, so that you are introduced to key definitions before we use them in class. Each new concept introduced in this course builds on earlier ones, so mastering key ideas is critical. If you get behind, it is your responsibility to seek help right away! Talk to your teammates or the instructional team. **Everyone wants you to succeed, but it is up to you** to take advantage of the assistance that is available.

Bring the textbook and a scientific calculator to class every day. If you must miss class, it is your responsibility to find out what you missed; get this information from your group members. Additionally, if you are going to be absent, inform your team members so they can be prepared to be short-handed that day. If a member of your team is absent without notifying you, contact them to let them know that they were missed.

Be a full participant during the in-class activities. You'll be amazed how familiar the quiz and exam questions will be if you do this!

### Textbook

***Matter and Interactions, 3 ed., Chabay and Sherwood (John Wiley & Sons, Inc.) Volume 1: Modern Mechanics. ISBN-13: 978-0-470-50345-4***

This is the official textbook for this course. Be sure to see below/later for alternatives.

The UC Bookstore price for this text is \$145.00 (New), and \$108.75 Used. At the time of writing this, there were only used copies available. The publisher's retail price is \$145.95.

On August 16, I found an unknown number of copies in stock at [www.amazon.com](http://www.amazon.com) (claimed to be new) for \$103.91. There are also used copies available through Amazon, priced from \$50.00. Caveat Emptor.

(A little price history: The publisher's retail price was \$134.95 in Fall, 2011. In Fall, 2010, Volume 1 of this text cost \$129 (New price) in the UC Bookstore. There were no used copies in the UC Bookstore at that time. In 2009, the used UC Bookstore price, for the second edition, was about \$89, and the publisher's retail price was \$115; the previous year those prices were \$79 and \$104, respectively.)

**Please:** I understand and agree that textbooks are outrageously overpriced, especially at college bookstores, and I think that you should get the best price you can. However, it is important to have your textbook **SOON**, because it is very easy to fall behind in a physics class. So please make getting this textbook, from somewhere, a priority and do your best to have it by the second day of class.

If and when you take Physics 136, you will need volume 2 (Electric and Magnetic Interactions), but

you will be responsible for knowing the material in Volume 1, so plan on keeping your Volume 1 (for a while, at least)!

### **Alternatives to the official textbook**

**e-book:** WebAssign, the online homework system that we will be using (more about this later), offers an upgrade beyond normal access for the third edition of Matter and Interactions, for a price of \$17.25 (per semester). The normal WebAssign access cost is \$25.95/semester, so this yields a total cost for WebAssign plus the e-textbook of \$43.20. The e-book is delivered via Adobe/Macromedia FlashPaper, and you read it on a computer display. You can also print it out and put the pages in a binder. You may find that the inconvenience of having to read the text on your laptop display or to print it and keep track of all the pages may be worth the lower price of the e-book.

**Earlier editions:** There are first and second editions of the Matter and Interactions textbook volumes. I don't recommend the first edition, because many improvements were made in the second and third editions. The second edition is acceptable, but some material is presented in a different order. I will try to provide a mapping, or cross-reference, between the second and third editions, which can be used to convert chapter-and-section references in the third edition to (roughly) comparable material in the second edition. There are probably lots of used copies of the second edition available.

### **Text study**

Review the course schedule/calendar carefully to see what textbook sections to study and what topics are being discussed during the upcoming week. Read the assigned text sections thoughtfully, **before they are covered in class**.

Do the "stop and think" activities marked by "?" in the text. Identify the most important concept in each section of the text.

Get help with any definition, concept, or reasoning that was not clear to you from the reading. After studying the textbook sections, work through the assigned WebAssign questions to check your understanding. Some students find it helpful to take notes from the textbook reading.

It will usually take you much longer to complete the WebAssign work if you do not first read the textbook sections and do the exercises in the text, because you won't be properly prepared and will find yourself thrashing around, trying one answer after another.

## **Assignments**

### **Readings**

You are responsible for reading the textbook and working assigned problems. You may be assigned homework problems on material that has not been covered in class. There may also be short reading quizzes (which may not be announced in advance) at various times in the semester. You should start the homework early and get help if needed before the problems are due. Check the course schedule/calendar regularly for due dates.

### **Homework**

Individual homework will be submitted via the WebAssign online homework system. You will be introduced to WebAssign during the first class. It will be necessary for you to purchase access to WebAssign (see below), but there will be a free grace period during the first 2 weeks (approximately) of class. Assignments will on average consist of 4 to 8 exercises from the textbook. You will be allowed a limited number of submissions (or attempts to get the correct answer).

WebAssign will tell you immediately if your numerical answers are correct, but homework solutions will not be posted. Your task is to make certain that you understand how to solve the problems by getting help before they are due or asking about them in class.

**Extra Submissions:** You will be able to request additional submissions beyond the initial limit, but there may be a percentage penalty assessed for correct answers beyond that initial limit (typically 5% for each additional submission). Sometimes extra submissions do not make logical sense - for example, a true/false question will only have one submission and extra submissions will not be possible; also, a four-choice multiple choice question cannot sensibly have more than 3 submissions.

**Homework Extensions:** You will also be able to request an extension, permitting you to submit homework beyond the original due date and time; this may also incur a penalty (typically 5% off any credit earned after the original due date/time). When the due date has passed, a link will appear at the end of the online assignment that you can use to request an extension. The extensions are automatically granted during a limited period following the due date/time; after that you will have to ask the instructor (and provide a plausible excuse, as well as a reasonable new, extended due date). **Note:** WebAssign will offer to show you an answer key after the original due date and time. *Do not view the answer key* if you expect or intend to request an extension of the due date. Requests for extensions after you have viewed the answer key will be automatically denied.

### WebAssign Access

Access to the WebAssign online homework system is required and can be obtained through a access-code-card at textbook stores or online at [www.webassign.net](http://www.webassign.net). Note that there is a free-access grace period for approximately 2 weeks at the beginning of the semester, after which purchase is required. For Fall semester, 2012, code cards at the UC Bookstore are priced at \$32.50/semester. Online purchase may be more convenient (you don't have to enter a code number from a card) and more economical (\$25.95/semester), but requires an online credit or debit card transaction. **Caution:** there are some access-code-cards available at the bookstore (for some math courses, for example) that are incompatible with the Physics 135 access. Be sure you are getting a code card for Physics 135. The difference is in what is called the code prefix. For more information, see [http://www.webassign.net/user\\_support/student/cards.html](http://www.webassign.net/user_support/student/cards.html).

### Homework Journal / Notebook

You will be required to keep a graded "homework journal" which shows how you solved the problems from the assignments. The purpose of the journal is two-fold: it enhances your reflective learning by improving your organizational skills, and it allows us to monitor your progress in problem-solving, something that is difficult to do with WebAssign alone. Written work must include labeled diagrams, defined variables, general physics equations, algebraic solution(s), numerical solution(s), units, and should include a statement or conclusion about how the problem contributes to your learning. We encourage you to use a good problem-solving strategy, and will discuss strategies in class. **Note that, on exams, you must often demonstrate the structure required in the homework journal in your solution of exam problems, in order to receive full credit.**

### Group work

You will be assigned to a group (probably by the second lab exercise). Many class activities will require you to work together with your team, utilizing appropriate group roles. On each group work assignment, your group must designate a **manager** to organize the work and make certain everyone understands who is supposed to be doing what, a **recorder** to prepare the final solution, and a **skeptic/checker** to verify the final solutions for correctness and to ensure that everyone in the group understands all the solutions.

These roles must rotate for every new assignment.

You are welcome to work on WebAssignments with your team, but each team member should set up and solve the assignment individually. Then the team should get together to check results and resolve conflicts.

You are encouraged to study with your team as much as possible. Work together to prepare for tests and quizzes. ***If your team's average score on a test is 80% or better, each team member will get an extra 5 points added to their score for "teamsmanship."***

When groups are assigned, group members will be encouraged to negotiate and sign a group contract. Sample contracts will be available. If you are not satisfied with the way your group is working, first try to discuss it with your group members. If you can not arrive at a satisfactory solution, then discuss it with your instructor. Groups will periodically change throughout the semester.

### Laboratory

You will be offered hands-on, inquiry-based activities during the class periods that allow you to

uncover or explore various aspects of a physics concept. Labs will vary in length and complexity. Some labs may require formal lab reports that should follow basic scientific report guidelines. Labs will be done in groups.

Some lab exercises will involve the construction and application of a computer simulation, using VPython, as a means of exploring and visualizing the consequences of a particular theoretical prediction. VPython is a freely-available variant of the open-source programming language, Python, and will be available through a link on the course Blackboard site. Computation has become an indispensable part of "doing science", to the extent that most branches of science now recognize computation as being on equal footing with theory and experiment.

Lab reports must be a Word or similar document and submitted (by the group recorder) electronically, via WebAssign.

There will only be a few formal lab reports due during the semester. On the other hand, there will be many in-class informal lab write-ups consisting of diagrams, formulas, tables, graphs, etc. that will become part of your class notes.

You must attend class during the day the lab is done in order to receive credit for it. If you have an excused absence, you may be able to reschedule a time to make up the lab. In any case, the lab must be completed within one week of the original date.

To receive credit for the lab report, you must have an assigned role and contribute to the lab report. If a member of the group does not contribute to the report, that person's name must not appear on the group lab report. You may receive partial credit for a lab if you write it up on your own, but before this is done, you must have the permission of the instructor.

### Notes

You should keep notes of all of your class work, including hands-on activities. This will help you when you review for quizzes and tests. Examples of good class notes are available. Tips from previous students (at one of the pioneering institutions) on how to take good notes are worth reviewing. The instructor may periodically collect your notes for grading. This will count toward your class participation grade.

### Facility Rules

Interactive learning requires a number of resources. Classroom computers will be used for some of the activities. Because it is easy to get off track while doing activities, it is necessary to restrict access on the computers. The following rules will be enforced during class whether using a classroom computer or your own in Room 207. Students who need to use a computer for any of the restricted functions will be asked to use some other facility.

1. **No instant messaging.**
2. **No email**, except to send yourself class-related files.
3. **No accessing non-class related URLs.**
4. **No cell phone use**, except to take photos of whiteboards or of apparatus for lab reports.
5. **No food or drinks** (this includes water and gum) **are allowed in Room 207 at any time.**

### Testing

Testing will consist of hour exams and quizzes. Quizzes may be administered using WebAssign. Hour Exams will be traditional paper exams.

#### Hour Exams

Three hour exams are scheduled throughout the semester. Dates for the hour exams are September 28, November 2, and December 10 or 12, depending on section. Exam dates are also listed in the course calendar. The first two exams utilize the Friday class meeting time; the third exam will be given during the University-mandated time and date for a final exam period. The

third (and final) exam will concentrate on material from the last third (approximately) of the course, but may be partially comprehensive --- *i.e.* it may cover some material from the entire course over the semester, especially to the extent that physics is a subject that builds on itself. Similarly, the second hour exam may depend to some extent on material covered in the first third of the course.

The exams are closed-book, but you will be able to use a supplied equation sheet, which will also have values of important constants and other useful quantities. You will have access to the equation sheet well in advance of the exam date.

One of the questions on each exam will be a "group exam problem". This problem will usually be assigned to cooperative learning groups during the class meeting prior to the exam, and collected at the end of that meeting. A very similar problem (with perhaps numerical quantities and minor aspects of problem geometry changed) will appear on the hour exam.

Note that, as stated earlier, if your team's average score on an exam is 80% or better, each team member will get an extra 5% points added to their score as a "teamship" bonus.

### Quizzes

Periodic (and possibly unannounced) quizzes will consist of a few short problem-solving and descriptive questions designed to take you 10 minutes or less, if you are prepared. They may (or may not) be administered with WebAssign (online). They are to be taken with no books or notes. A class equation sheet may be used. The quizzes will usually be given on Fridays, but not on scheduled exam days. There will be no make-up opportunities; however, the lowest quiz score will be dropped.

All testing is performed under the University of Tennessee's academic integrity policy as expressed in the Honor Statement (see *Hilltopics*) or any undergraduate catalog). On the hour exams, you will be implicitly pledging that your work complies with the Honor Statement by placing your name on the exam cover sheet.

### Grades

Final course grades will be determined by a weighted average, as shown in the table below. Grades will never be curved downward – if everyone in the class does well, everyone can get an A. It may happen that a particular exam is unexpectedly difficult and no one does well; in that case, the grades for that exam may be curved upward, or the grades may be left as is, and consideration of a curve left for final grade time.

**Course Grade Weighting Scheme**

Component of grade	Weight
Hour exams (3 @ 15% each)	45%
Quizzes (drop 1)	10%
WebAssign homework	20%
Homework journal	5%
Lab	15%
Classroom participation	5%
<b>Total</b>	<b>100%</b>

The classroom participation component of the above table depends on in-class activities, clicker questions, group cohesiveness, attitude, etc. Attendance is required, even though there is no explicit grade for it. You will need to read before coming to class and arrive with questions ready to be asked. Doing so will lead to a higher participation score and probably to a higher overall grade.

### Grade Breakpoints

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A	n/a	93-100	90-92
B	87-89	83-86	80-82
C	77-79	73-76	70-72
D	67-69	63-66	60-62
F		0-59	

## Resources

### Tutorial Center

The Physics Department operates a tutorial center on the second floor of Nielsen. See [http://www.phys.utk.edu/tutorial\\_center/](http://www.phys.utk.edu/tutorial_center/) for an up-to-date listing of dates, times, and places of operation.

### Student Success Center

If you are having academic difficulties beyond what can be handled in the Tutorial Center or by visits to office hours, consider consulting with the Student Success Center at 812 Volunteer Blvd. Phone: 974-6641; email: [studentsuccess@tennessee.edu](mailto:studentsuccess@tennessee.edu); web: <http://studentsuccess.tennessee.edu>.

### Disability Services

Reasonable efforts will be made to accommodate students with certified disabilities. For more information, see <http://ods.utk.edu>, phone the Office of Disability Services at 974-6087, or visit their office at 2227 Dunford Hall.