Physics 135 Course Syllabus, Fall Semester 2018

Class Meeting Times

Section 001 (CRN 41804) meets Monday and Wednesday: 1:25 - 3:20; Friday: 1:25 - 2:15
Section 004 (CRN 41805) meets 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: 865-974-7818
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 Assistants TBA

Official 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 introductory 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, mechanical waves, and microscopic aspects of thermodynamics. This amounts to most of Chapters 1 through 12 of the textbook listed below, plus portions of a supplemental chapter, S3.

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.

You should notice from the very moment you enter the classroom that this is not your mother's or father's college physics course. Because our approach is very different from the traditional lecture-based course **with a separate laboratory section,** ***it is very important that you read this syllabus thoroughly.*** Understanding a little about the process will help you succeed in this environment.

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.

Some call this approach a “flipped classroom.” It is founded on a National Science Foundation funded, research-based physics education program called “SCALE-UP” – Student Centered Active Learning Environment with Upside Down Pedagogy, developed by Dr. Robert Beichner at North Carolina State University, and has been replicated, with modifications, at well over 250 institutions.

Collaborative Work
Scientists and engineers work in groups as well as alone. Social interactions are critical to their success. Many 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
Math: It is very important that you have a good, working grasp of mathematics at the pre-calculus level, that you have either have taken the equivalent of Mathematics 141 or 147 (Calculus I), or are taking one of these two courses in parallel with this course. 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.
Computing: Computational methods have become an essential part of “doing physics”, and we will develop computer models of many aspects of the physics we study in this course. No prior experience with computer programming is required, however - we will teach you everything you need to know for the computer modeling that is an important component of the course, and the required textbook contains considerable support for developing computational models of physical phenomena.

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!

Required Textbook and Online Homework Access:

Matter and Interactions, 4th ed., **Chabay and Sherwood (John Wiley & Sons, Inc.) Volume 1: Modern Mechanics.**

This is the official textbook for this course. It comes in a number of forms, but (unfortunately) effective this fall, there is one form that the publisher is forcing you to purchase, even if you have or want one of the others – an online "eBook" that is included with the WebAssign online homework system we'll use. You will be introduced to WebAssign during the first class. It will be necessary for you to purchase access to the eBook version of the text and to WebAssign (as a combination), but ***there will be a free-access grace period during the first 2 weeks of class*** (counted from midnight of the day before the first day of class).

Pricing: The homework + eBook access price for a single term/semester is $90.70 if purchased with a credit (or debit) card online. There will be some provision to purchase this access at the VolBookstore, but it will probably cost a bit more. A multiterm option is also available for $121.00 online – this is a good deal if you are committed to taking both semesters of this course (i.e. PHYS 136 and PHYS 136), and you do not need to take the two courses in successive semesters.

The main problem with the eBook approach to textbooks arises if you are interested in having a reference book after the course is over – maybe you want to major in physics, for example. The eBook 'evaporates' when the semester is over. There are a range of solutions if you agree that this is a problem. One is a "Kindle" version that the publisher offers for $.... Another is to purchase a paper copy of the text. In this case, I recommend you use Google or Amazon to find copies of the text that are likely to be cheaper than what you'll find direct from the publisher or a brick-and-mortar bookstore.

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.

You cannot read a physics text the way you read a work of literature! It doesn't matter whether it's a physical textbook or an eBook. Your reading pace will (and should be) much slower in a physics text, and it is not uncommon to find yourself, or any other smart person, reading some sentences and/or paragraphs several times. It takes time and patience to develop this skill, but it is a skill that is transferrable to other technical subjects. If you are a student majoring or hoping to major in any field of science, math, or engineering, it is well worth your time to learn to effectively read a physics textbook.

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 **QUESTION** in the text, and attempt the exercises labeled by ***Checkpoint*** – sometimes these exercises show up in the homework in a slightly modified form. 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.

Homework
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). 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.
There will be homework discussion forums available on WebAssign, as well as a forum for general discussion of non-homework, course-related topics – labs, VPython, relevant stuff found on the web, etc. Please read the opening message in the general forum about what is appropriate to post in the Homework Discussion Forum.
The major advantage of an online homework system: WebAssign will tell you immediately if your answers are correct, and you get (immediately, or later, at your choice) several chances to get the answers correct.
The major disadvantage of an online homework system: you do not automatically get a printed or written record of how you solved a given problem unless you write out your solutions on paper. This is important because you probably need a mechanism for remembering how you solved a given problem when it comes time to study for a quiz or exam. We therefore strongly recommend that you solve the problems on paper before entering answers into the WebAssign system, and accumulate those solutions in a notebook that we'll call your Homework Journal (see the Homework Journal section, below). ***Homework solutions will not be posted.***
Late homework: You may request an extension for a past due homework assignment, but there may be a point penalty (typically 5%). 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). ***Under no circumstances whatsoever will a due-date extension be approved if the WebAssign log shows that you have seen the key for the assignment.***

Homework Journal
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, numerical solution, units, and 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 an exam problem, in order to receive full credit for that exam problem.

Group work
You will be assigned to a group (during the second or third class day). 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 should/must rotate for every new assignment.

You are welcome to work on WebAssignments with your group, but each group member should set up and solve the assignment individually. Then the group should get together to check results and resolve conflicts.
You are encouraged to study with your group as much as possible. Work together to prepare for exams and quizzes. ***If your group's average score on an exam is 80% or better, each group 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 cannot arrive at a satisfactory solution, then discuss it with your instructor or TA. Groups will periodically change throughout the semester.

Laboratory and Computational Physics Exercises
You will be offered hands-on, inquiry-based activities ("labs") during the class periods that allow you to uncover 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, others may be less formal and designed to acquaint you with phenomena that most people don't develop an intuitive feeling for in everyday life. Labs will be done in groups.
Computation has become an indispensible part of "doing science", to the extent that most branches of science now recognize computation as being on equal footing with theory and experiment. Accordingly, 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 widely-used open-source programming language, Python, and will be available through a link on the course web site or at vpython.org.
Lab reports must be a Word or similar document and submitted (by the group recorder) electronically. Most labs will be submitted 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, and to serve as stopwatches.
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 either December 10 (section 001) or December 11 (section 004), 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.
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 "teamsmanship" bonus.

Quizzes
Periodic (and possibly unannounced) quizzes will consist of one, two, or at most a few short problem-solving and descriptive questions designed to take you 10 minutes or less, total, 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.

Academic Integrity
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. The letter grade breakpoints are fairly conventional, and are applied to the final course score determined from the weighting scheme table. Grades will be maintained using the WebAssign online gradebook.

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%
Total	**100%**

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

	+		–
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/ 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; 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.