Course goals:

Students will see the power and beauty of Newtonian Mechanics and Special Relativity, practice problem-solving skills for the mathematical sciences, and get to know a remarkable group of peers. Students will see topics not usually taught in 1st-year college courses, like Lagrangian mechanics and the Inertia tensor, and will study other topics like Special Relativity in more depth. List of TENTATIVE CLASS TOPICS.

This is a very aggressive schedule and we may slow down at times. But it will be fun if it works.

Course format:

Interactive classes will introduce concepts and work through examples. Sections will explore examples in greater depth. Principles of Scientific Inquiry (PSI) is the laboratory component of Physics 16. Topics include experimental design, model testing, error analysis, basic programming, and oral presentations. PSI will meet weekly throughout the semester and is graded Pass/Fail. The laboratory component is optional but very strongly recommended. It is required if you are going to count Physics 16 for the Physics and the Chemistry and Physics concentrations. If there is any chance that you may want to concentrate in Physics or ChemPhys, you would be crazy not to take it. But even if you are certain that you will concentrate in a different field, we think that you will find the lab component very useful. LAB SCHEDULING IS HERE

Typical enrollees:

Students with at least AP-level background in physics and math. The students are mostly first-years, but there are usually a few upper class students who contribute a lot to the course. If in doubt whether to take Physics 15a or Physics 16, students may want to start in 16 because it is relatively easy to switch to 15a in the first few weeks.

When is the course typically offered?

Physics 16 is offered every year, only in the fall.

What can students expect from you as an instructor?

Prof Georgiâ€™s teaching style emphasizes personal interaction. He hopes to get to know every student in the class and enjoys helping them with their Harvard careers (and sometimes beyond).

Assignments and grading:

There will be weekly problem sets, two hour exams, presentations, and a final. The problem sets will have two parts: there will be a handful of self-graded core-skill problems, designed to help the student learn the basics. The core skills will also be discussed in class and in section, but there is no substitute for working through them on your own. They must be submitted to the course Canvas site by 9pm on Tuesdays, soon after which the solutions will be available and the student can grade their work themselves as part of the regular assignment. There will also be two or three more interesting â€œregular problemsâ€ each week designed to develop problem solving skills. Collaboration and interaction with the professor and TAs is encouraged and Physics Night - see below - is great for this, but you must write up the regular problems on your own. The regular problems must be submitted to the Canvas site before the beginning of class on Thursday, but students can earn **an Effort** (see below) for submitting them before 1am. The exams (hour1, hour2, and final) will be a subset of the core-skills problems, minimally modified, and short to avoid time pressure (See Exam Scoring and Efforts below).

The presentations (on three interesting problems) will be done in self-organized groups during reading period. The numerical grade will be determined by percentage scores in hour1, hour2, final, regular problems, and presentation with weighting 10:20:20:40:10. Letter grades will be appropriate to the advanced level of the course and students who do the work and contribute will do well.

Exam Scoring and Efforts:

In the period before each exam, students can accumulate â€œ**efforts**â€ for early regular problem submissions, useful participation in class, section and physics night and particularly outstanding, easily readable (see LaTeX) work on their regular problems. Conversely, students will lose efforts for late submissions. Efforts modify the way exams (hour exams and the final) count in your favor. If you have E efforts and your raw fractional exam score is R, your fractional grade on the exam will be $R(E+10)/(3E+10)$. Thus for example, if you have 10 efforts, a fractional raw score of 0.64 would be recorded as 0.8. Negative efforts are bad! If you have efforts, a raw score of 0.64 would be recorded as 0.41. Your Effort total will be reset after each exam.

Physics Night:

Every Wednesday night during term time, physics students from many classes gather in the Physics Reading Room, Jefferson 450, to work together on their problem sets. Professor Georgi will almost always be there and other faculty and TFs will come by as well. This is a place where many blocking groups and life-long friendships have formed

Readability:

The core skills problem submissions will be looked over to ensure that students are doing their self-grading conscientiously. The regular problems on the sets will be carefully graded and returned with comments. This requires that all submissions be easily readable and submitted to Canvas as PDF files. Unless you have excellent handwriting and can write in the equivalent of 12pt font or larger, you should use a word processing system to produce your PDF. LaTeX is preferred (and probably easiest after you get used to it). Whatever you do, leave generous margins and clear spaces between the problems for comments (bits are cheap so putting each part on a separate page is one reasonable strategy).

Latex:

The computer typesetting language LaTeX is the standard for written communication in the mathematical sciences, and is very useful for non-mathematical work as well. We strongly encourage (with Efforts) submission of your problem sets as PDF files typeset in LaTeX and will be happy to help you learn this important tool if you are not familiar with it. Harvard gives you an account on the Overleaf LaTeX system.

Mathematica:

Many of the materials will be in the form of Mathematica notebooks and you may find Mathematica useful for some problem sets.

Mathematica and Wolfram|Alpha Pro are available at no charge to Harvard University students. They are useful for solving technical problems, obtaining step-by-step solutions, and much more. To get access, go to wolfram.com/siteinfo and enter your Harvard email. Learn how to use Mathematica at wolfram.com/wolfram-u/

Sample reading list:

The textbook for the course will be David Morinâ€™s Classical Mechanics. We will read portions of the Chapters 1-13 and the Appendices.

Enrollment cap, selection process, notification:

None - all are welcome.

Past syllabus:

It will be quite different from previous years (and I hope for most students less time-consuming).

Absence and late work policies:

Get prior authorization from the professor. This will be granted only for real conflicts (not extra-curricular busyness). The core-skills problems in particular really must be submitted on time or early if you want Efforts. Plan ahead if you see a conflict coming.

Useful links:

Physics Department home page

The Hidden Curriculum

Physics in a Diverse Worldâ€”or, a Spherical Cow Model of Physics Talent

Fun links to Les Phys - the musical based on Physics 16:

Recorded Les Phys Songs from the album

Video of the first performance with subtitles

Act I: http://youtu.be/QOVGi9L1akI

9:10 - The Sound of Physics

15:30 â€“ The Section Song

30:30 - Working til Midnight

41:00 - Positive Definite Non-Degenerate Symmetric Bilinear Forms

49:00 - One Day More

Act II: http://youtu.be/ddjQF-466Js

Beginning - One of These Days

17:20 - Of All the Stupid Things

30:00 - Special Relativity

42:30 - God's Gift to Physicists

Other youtube

https://www.youtube.com/watch?v=Ga9lqUerEv8

The Section Song - from Les Phys - Society of Physics Students at Physics Night in the Leverett Dining Hall

https://www.youtube.com/watch?v=zFnPJD6lyD0

Positive Definite Non-Degenerate Symmetric Bilinear Forms - from Les Phys - Harvard Noteables

https://www.youtube.com/watch?v=wnb0JdHgPeE

Working Till Midnight - from Les Phys = Harvard Noteables