Physics 303: Physical Theory—Syllabus

Instructor: Itai Seggev ($\bar{e} \bullet t\bar{i}' \;\; s\check{e}' \bullet g\check{e}v$)

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1 Contact Information

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Office Hours: Mondays 3:00–4:30. "Office Hours" means that I promise I will be there and will give you priority over students from my other courses. You are welcome to drop by my office anytime, with the understanding that I may be busy.

2 Course Goals

This one-semester course covers introductory physics from the point of view of the calculus practitioner. We will review many topics from introductory physics (Physics 213-4) and examine how knowledge of calculus deepens our understanding, as well as cover new topics typically omitted from a trigonometry-based course. Specific goals for this course include:

1. improving the ability to explain the logic of a physics problem, both orally and in writing;
2. becoming comfortable using calculus as a problem-solving tool;
3. understanding the fundamental relationship between physics and calculus as well as the new insights calculus provides into physics;
4. mastering calculus-based physics models, especially Newton's second law, Maxwell's equations, and the wave equation.

3 Course Format

The course meets TuTh 9:30 AM – 10:50 AM. Attendance is expected. Homework assignments will be passed out on Thursdays and be due the following Thursday. Optional "Problem Sessions" will be held Wednesday evenings from 7:00 PM – 8:30 PM. Students will make one oral presentation during the semester. There will also be a term paper, which will be worth 20% of the homework grade.

3.1 Grade Breakdown

The course grade will be based on the following formula:

- homework assignments (45%) (including term paper),
- attendance (10%),
- presentation (5%),
- midterms (10% each), and
- final exam (20%).

3.2 Homework

Homework assignments are your best opportunity for working out confusions and mastering the material. While you are encouraged to discuss problems with your classmates, **your write up must be your own!** Finding a joint solution and then each person copying that common solution is strictly prohibited. On the other hand, going home and each person writing up a solution on his or her own after working together to solve a problem is perfectly acceptable. While this is a fine line, it is remarkably easy for the grader (me) to tell which occurred, based on the quality of explanations provided in the solutions turned in. Please do a favor to both your learning and your grade by following these rules.

For more on my expectations on homework solutions, please see the document "The Care and Feeding of a Physics Problem Set."

3.3 Term Paper

The term paper will be fairly short: 3-5 pages, single spaced. I will provide a list of approved topics, but you are welcome to suggest your own. The papers should explain additional topics not covered in class, or discuss applications of topics covered in class to "the real world." The greatest weight will be given to clarity of exposition. I will provide more details as the semester progresses.

3.4 Oral Presentation

Starting the third week of the semester, one student will make an oral presentation each week. The topics will be chosen jointly by me and the student. These might be presentations of a solutions to a homework or supplementary problem, or cover a related topic which I will not cover in lecture. They should be about 15 minutes long (not including a few minutes for questions). You will be graded equally on the correctness of the physics, the clarity of your presentation, and the mechanics of your delivery (projecting your voice, good boardwork or overheads, etc.).

3.5 Exams

The two midterms will be on or around Thursday, September 29, and Thursday, November 10. The final exam is scheduled for Wednesday, December 7, at 8am. All tests will be in-class, closed-note, and closed-book. However, you will be permitted to bring in an $8.5'' \times 11''$ sheet of paper with any formulae or notes you want on it. The only rules are (1) it must be readable by the unaided eye, and (2) you must write everything yourself (i.e., photocopying the book or somebody else's notes is not permitted).

3.6 Textbook

The textbook for this course is *Fundamentals of Physics, 7th ed.*, by Halliday, Resnick, and Walker. We will cover material from chapters 1-13, 15-17, 21-24, and 28-33 (although certainly we won't cover all the topics in those chapters!). We will pay special attention to chapters 15, 23, 32, and 33, which cover material typically omitted in a trig-based course. If time permits, additional topics may be covered.

This textbook is a good reference, and offers many fine resources for students. These include solutions to selected problems on the web, a students solution manual, and more. You are encouraged to read the book and avail yourself of these resources. However, bear in mind that this book is not the final word on physics. I may supplement the book with outside material. I may also make statements which differ from, or outright contradict, the book. This is a natural result of the fact that even physicists can have differences of opinion. Please be assured that these differences will be largely stylistic or presentational—pretty much everybody agrees as to the content of Newton's laws and Maxwell's equations. (At some point you will need to develop your own point of view about physics, although it is likely that you will find this difficult at this early point of your education.)

3.7 Course Outline

The table below shows a *tentative* schedule for the course, including the corresponding chapters from the book. We will probably not follow this schedule precisely, but we will follow the general order of the topics. (A date of ??? indicates a possible "additional topic".)

Schedule Changes: Since the class is so small, I will try to reschedule the lectures of October 4 and October 13th so that I may observe the holidays of Rosh haShana and Yom Kippur, respectively. In the week of October 4th, I may use the problem session as a substitute lecture if everyone can make it. October 13th may require a bit more creativity. I appreciate your understanding on this matter.

Week	Topics	Chapters in Book
08/23 08/25	kinematics in 1, 2, and 3 dimensions	2-4
08/30 09/01	forces, momentum, and Newton's laws	5,6,9
09/06 09/08	conservation of energy	7,8
09/13 09/15	rotational motion	10,11
09/20 09/22	oscillations	12,15
09/27 09/29	review of mechanics, **First Midterm**	
10/04 10/06	introduction to gravitation and electric fields	13,21,22
10/11 10/13	potential energy in gravitational and electric systems	13,24
10/18 10/20	Gauss's law	23
10/25 10/27	magnetic fields	28,29
11/01 11/03	electromagnetic induction	30,31
11/08 11/10	Maxwell's equations, **Second Midterm**	32
11/15 11/17	the wave equation	16
11/22 11/24	**Thanksgiving Break—Happy Holidays!**	
11/29 12/01	electromagentic and sound waves	33,17
???	electric circuits	25-27
???	Fourier analysis	Not in book