20th Century Physics

Physics 245 • Fall 2012

Instructor: Doug Juers Office: Sci 244
Hours: T 10-11; Th 1-4; also if my office door is open

Texts: *Special Relativity*, T.M. Helliwell (required)
Quantum Physics, J.S. Townsend (required)
Physics for Scientists and Engineers, R.D. Knight

Course Content and Goals

In introductory physics, we discussed the motion of one and two body systems under familiar conditions (Physics 155/65) and light as a wave (Physics 156/66). The Newtonian model works well for systems we looked at, such as thrown baseballs, moving cars etc., but it breaks under other conditions. When we're interested in more than 2 objects, when things are very small (i.e. in atoms and nuclei) or when they move very fast (i.e. in particle accelerators), the Newtonian model doesn't work so well. It also turns out that light is a very strange thing, and is more complicated than the straightforward wave description we employed previously. In this course, we will expand from simple Newtonian physics to other models that allow us to look at these other types of systems.

The goals of the course are the following:

1. To give you a background in thermodynamics, quantum physics and special relativity.
2. To give you a practical introduction to some more advanced mathematical tools such as differential equations and fourier analysis. You will use these in a more advanced way in Physics 246.

Grading

30%/40%/30% Problem Sets/Midterms/Final Exam

Problem Sets

I will assign problem sets most weeks, generally due on Friday evenings at 6 pm. I will grade at least two of the problems each week, which will form the basis for the problem set grade. Late problem sets will not be accepted, but I will drop your lowest problem set grade.

Exams

There will be two in-class mid-term exams and a final exam. The mid-term exams will be roughly weeks 6 and 12, and will be announced closer to those weeks.

Schedule Sketch - actual schedule will depart from this to some degree

Week	Topic	Text
1. Aug 27	Thermodynamics – 1st Law	Knight 16-19
2. Sept 3	Thermodynamics – Heat Engines	
3. Sept 10	Thermodynamics – 2nd Law & Entropy	
4. Sept 17	Light as particle	Townsend 1
5. Sept 24	Wave Mechanics	Townsend 2
6. Oct 1	Wave Mechanics/ Schroedinger Equation	Townsend 2
7. Oct 8	Particle in a Box	Townsend 3
8. Oct 15	Particle in a finite Well	Townsend 4
9. Oct 22	Other 1D potentials	Townsend 4
10. Oct 29	Formal Foundation of QM	Townsend 3 & 5
11. Nov 5	Spin & Fundamental Particles	Townsend 6 & 10
12. Nov 12	Special Relativity	Helliwell 1-5
Nov 19	Thanksgiving	
13. Nov 26	Special Relativity	Helliwell 6-9
14. Dec 3	Special Relativity	Helliwell 10-13
15. Dec 10	Final exam (Mon 12/12, 9 AM)	