Physics 351
Foundations of Physics II

Fall Quarter 2004: Oscillations and waves

MWF at 11:00 at Pacific 16.

This is the first quarter of a three-quarter course. This quarter and the first half of winter quarter will be devoted to oscillations and waves of all kinds, including matter waves. The second part of winter quarter and then spring quarter are devoted to thermal physics. We will try to develop practical applications and understanding of the material.

"In theory, theory and practise are the same. In practise, they aren't."
-Unknown Soldier

Instructor:

- S. James Remington
- email: sjr001 at uorxray.uoregon.edu (check address!)
- phone: 6-5190
- office: 377 Willamette
- office hours: UH 11:00-12:00 and by appointment

Text:

- Vibrations and Waves, A. P. French.
- Additional reading: consult any traditional textbook. One copy of the newest textbook by Tipler, Physics for Scientists and Engineers (Edition 5e) is on reserve in the Science Library

Homework:

There will be problems assigned each week in class, due on Monday. Considering the class size and in fairness to the grader, late homework will not normally be accepted, and in no case more than a week later.

Grader for problems:

- Qiyin Lin (OK to call him Lin)
- Email: qlin at darkwing
- Office: 216 Willamette
- Hours: Tue 10:00-11:00, Wed 10:00-11:00 (Drop-in Help Center) 147 Willamette

Help is also available from the physics drop in help center.

Problem assignments (Updated regularly):

- Monday 4 October. Read: Chapter 1 of French.
  Do the following problems from the class notes:
  2.1, 3.1, 3.2, 5.1, 6.1, 6.2, 6.3, 6.4, 6.5.
- Monday 11 October: Read Chapter 3 of French up to page 57, concentrating most on the subjects that we covered in the class notes and do the following problems from the class notes: 7.1, 7.2, 8.1, 11.1, 12.1.

Note: I encourage students to work together on the homework. I don't want you to just copy from someone else's work because you won't learn anything that way. However, if you work out the solution jointly with someone else or with a group, that's fine. Please write up the solution independently! Real science usually involves teamwork, so it's a good idea for you to learn how to
work on science with others. This policy is an exception to the normal university rule about doing your work. Of course, on exams, your paper has to be entirely your own work.

Available lecture notes in .pdf format:

- Oscillators

Reference Materials

- Intro to Euler's and other numerical methods (PDF)

Available Mathematica notebooks:

- samples.nb: Some additional examples of Mathematica commands
- programming.nb: Some examples of loops, function definitions, branches, etc. used for simple Mathematica programs
- Euler.nb: Euler's method for numerical solution of differential equations, with application to spring and mass.
- RungeKutta2.nb: Runge-Kutta method for numerical solution of differential equations, with application to the simple pendulum and the simple harmonic oscillator, with friction if desired.

We will use Mathematica from time to time, especially for numerical problems. That's partly because it is a useful tool to help us understand the subject and partly because students in science ought to learn how to use computers to do science. Mathematica was picked as a tool because it gives us all a common reference point. The university has a site license and copies of the program are installed on many of the computers in the labs. If anyone wants to use Maple, Basic, Fortran or C++, that's fine.

Exams:

- Midterm Exam: Monday 15 November (in class).
- Final Exam: Monday 6 December at 10:15.

Grading:

Overall course scoring: 25% homework, 20% each midterm, 35% final

Tentative schedule:

- Oscillations (Weeks 1-4; 12 days)
  - (2 days) Free vibrations.
  - (1 day) Complex numbers.
  - (2 days) Free vibrations in physics.
  - (1 day) Damping.
  - (1 day) Damping in physics.
  - (2 days) Forced vibrations.
  - (1 day) Forced vibrations in circuits.
  - (1 day) Review.
  - (1 day) Exam, Monday 25 October.
- Waves in one dimension (Weeks 5-7; 9 days)
  - (2 days) Wave equation and solution.
  - (2 day) Sound waves.
  - (1 days) Reflection and transmission at a boundary.
  - (1 day) Energy transmission.
  - (1 day) Review.
  - (1 day) Exam, Monday 15 November
- Waves in three dimensions and optics (Weeks 8-10; 8 days)
  - (1 day) Light waves.
  - (2 days) Reflection and refraction.
  - (4 days) Formation of images.
(1 day) Review.

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