Physics 152

Lecture 01

Wednesday, January 9, 2007

• Waves & Optics
• Electricity
• Magnetism

Outline

• Class meetings & resources
• Mastering Physics
• Warm-Ups
• Regular Homework
• Exams
• Grading
• Simple Harmonic Motion intro

Public Service Announcement

As a courtesy to your fellow classmates and to your humble instructor...

Please disable all cell phones and pagers BEFORE class.

Lecture Faculty

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Office Location: NSC, Rm. 144
Office Hours: MW 3:30 - 4:30 pm or by appointment

Class Meetings

• NSC 119
• PowerPoint Lectures
• Demonstrations
• Interactive Exercises
• 10:10 - 11 am, MWF

Class Participation

• Come to lecture prepared: Try Reading the Book!
• Not everything will be covered in lecture
• Class Worksheets for in-class exercises
• Surveys
• 5% of final grade -- easy points!
Help Sessions

- We will schedule these beginning in 2 weeks.
- Stay tuned for more info

Class Web Site

- Class Policy
- Lecture Notes
- Assignments
- Homework
- Exams
- Solutions
- Grades
- Adobe Acrobat Download

http://physics.valpo.edu/courses/p152/

MasteringPhysics.Com

- www.masteringphysics.com
- Used for warm-up exercises and homework
- All assignments are due by 8 am on the dates noted.
- Randomized by student
- Log-in and register for our course ASAP (course ID: MPMorris0012)
- No Late Homework Accepted!

Graded Homework on MasteringPhysics.Com

- 5 times during the semester
- More points available than necessary to get 100%
- Feel free to work together, but each of you must submit your own work.
- Homework 1 due 2/2 - but don’t wait until the last minute to start

Warm-ups on Mastering Physics.Com

- 22 assignments during the semester (about twice per week)
- Cover material that has NOT yet been presented in class
- Read the book first
- Warm-ups prepare you for lecture
- First one due Wed., 1/17 (tutorial on using MasteringPhysics.com)

Mid-Term Exams

- 2 during the semester
  1) Thurs., Feb. 15th  5 – 6:30 pm  Ch 14, 20 - 23
  2) Thurs., Apr. 12th  5 – 6:30 pm  Ch 25 - 31
- Essay
- Free response
- Multiple choice
- Closed-book, closed-notes
- No make-up exams will be scheduled without a VERY good reason
Optional Mid-Term Exam Reworks

• Do NOT turn in exam – use clean copy
• No time limit (other than due date)
• Consult any resources.
• You’ll earn back 1/3rd of the difference between your original grade and your rework grade.

Final Exam

• Comprehensive
• More material on the last section of the course
• Mon., May 14th, 10:30 am - 12:30 pm.
• Format same as for mid-term exams
• Everyone MUST take the Final Exam

Grading

• Class Participation 5%
• Graded Homework 40%
• Warm-ups 12.5%
• Mid-terms (each) 12.5%
• Final Exam 17.5%

NOTE: Grades will not be changed after 5 pm on the 7th day after the assignment/exam is returned.

Grading are NOT curved

• The absolute toughest grading scheme is:
  A  90 - 100%
  B  80 - 89%
  C  70 - 79%
  D  60 - 69%
  F  Below 60 %

• The grade boundaries may shift downward

Things you should know...

We’ve already studied some vibrational motion, when we were examining the curious behavior of springs and objects that interact with them. We will now formalize the math and expand our studies to objects that behave similarly to our spring, such as the pendulum and rotating objects.
We're going to start by reviewing some of the basic properties of springs.

- A spring resting in its natural state, with a length $L$ exerts no horizontal force on anything!
- However, if we compress or stretch the spring by some amount $\Delta x$, then the spring is observed to exert a force in the opposite direction.

Hook discovered this force could be modeled by the mathematical expression

$$F = -k\Delta x$$

Notice that this force operates along a linear line! $x = 0$ defined at the natural length of the spring.

Which means that if we looked at the plot of Force versus compression/stretching $x$...

Slope of this line is $-k$, where $k$ is the spring constant.

Notice that the force exerted by the spring always OPPOSES the direction of the displacement.

We call such a force a **Restoring Force** because the force acts to “restore” the particle to its original position.

If we look at the work done by an applied force which compresses the spring through a distance ($-x_f$)...

$$W = \int F \, dx = \int -kx \, dx$$

$$W = \frac{1}{2} kx_f^2$$

Work done BY the external force ON the spring.

This energy is stored in the spring...

Potential Energy of a spring is

$$U_s = \frac{1}{2} kx^2$$

So, for spring problems, we have TOTAL MECHANICAL ENERGY given by

$$K + U_s + U_x$$

And it is THIS quantity which will be conserved absent other, outside forces.
Our socialite, bored from counting Krugerrands, decides to play with his new spring toy.

Predict the motion of the mass oscillating on this spring as explicitly as possible.

Assume no friction and no air resistance.

Worksheet Problem #2a

This type of oscillatory behavior is known as Simple Harmonic Motion.

An object in simple harmonic motion displays an acceleration that is proportional to the displacement and in the opposite direction.

Worksheet Problem #3

Worksheet Problem #2b

Worksheet Problem #1