FALL 2010: PHYSICS 170 – GENERAL PHYSICS I

MTWF 9:30-10:20 (Section 1) WAT 420

Instructor: Eric B. Szarmes (szarmes@hawaii.edu)

Office hours (tentative): MW 12:00–12:30 (WAT 421); F 12:30–1:20 (WAT 420)

Course description: This course is a calculus-based introduction to general physics, covering the mechanics of particles and rigid bodies, wave motion, thermodynamics and kinetic theory. The primary goals of the course are to gain a solid understanding of fundamental physical principles and their mathematical expression, as required for applications in the physical sciences and engineering, and to introduce and develop the application of mathematics as the basic language of physics. While these goals are achieved in part through the working of assigned problems, the course is not one in problem-solving techniques. Indeed, advances in the physical sciences can be realized only by properly recognizing and formulating new problems in the first place. And to perceive and tackle new problems, it is a solid understanding of fundamental physical and mathematical principles which is critical.

Prerequisites: MATH 242 (or concurrent) or MATH 252A (or concurrent). MATH 216 may be substituted with consent.

Textbook (required): Young and Freedman, *University Physics, Volume 1*, 12th ed., Pearson Addison-Wesley, San Francisco, 2008.

Internet (required): This course uses the online resource *Mastering Physics*™ for homework and quizzes.

iClickers (required): Available at the UH Bookstore.

Grade distribution:

iClicker Participation:	5%
Daily and Weekly Homework:	35%
Quizzes and Midterm Exams:	40%
Final Examination:	20%

Grade assignment (*approximate*):

A+	90 >	B+	76–80	C+	66–70	D	50–56
A	84–90	B	70–76	C	60–66	F	< 50
A–	80–84			C–	56–60		

COURSE OUTLINE

1. Preliminary Review (~1 day):
   - Overview of physics — *Ch 1*

2. Kinematics of Particles (~2 weeks):
   - motion in 1 dimension; displacement, velocity, and acceleration — *Ch 2*
   - introduction to vectors; vector addition — *Ch 1*
   - motion in 2 and 3 dimensions — *Ch 3*

3. Dynamics of Particles (~2 weeks):
   - Newton's laws of motion — *Ch 4*
   - applications; friction, circular motion — *Ch 5*

4. Work and Energy (~2 weeks):
   - vector algebra: the dot product — *Ch 1*
   - work, kinetic energy, and the work-energy theorem — *Ch 6*
   - potential energy and the conservation of energy — *Ch 7*

——— *(Midterm examination 1)* ———

5. Systems of Particles (~1 week): *Ch 8*
   - momentum and impulse; center of mass motion
   - conservation of momentum and energy
   - collisions; rocket propulsion

6. Rotation and Angular Momentum (~2 weeks):
   - angular kinematics and energy *Ch 9*
   - vector algebra: the cross product *Ch 1*
   - angular dynamics; torque and Newton's second law *Ch 10*
   - rigid bodies; conservation of angular momentum

7. Classical Newtonian Gravitation (~1 week): *Ch 12*
   - Newton's law of gravity
   - Kepler's laws of planetary motion; application to orbital mechanics

(Midterm examination 2)

8. Oscillations and Waves (~2 weeks):
   - simple harmonic motion *Ch 13*
   - damped and driven oscillations; complex analysis
   - simple wave motion; the wave equation; boundary conditions *Ch 15*
   - superposition principle; sound waves

9. Heat and Thermodynamics (~3 weeks): *Ch 17–20*
   - temperature; kinetic theory of gases; ideal gas law
   - the First Law of thermodynamics
   - internal energy and heat capacities
   - entropy and the Second Law of thermodynamics
   - heat engines

10. Review (~1 week)

(Final examination)

Daily Homework

Daily homework (usually consisting of 2 problems) will be assigned from Mastering Physics, and must be submitted by the start of class each day. Often these problems will involve simple calculations or be of a conceptual nature, but may require you to read ahead in order to answer them. The purpose is to give you the opportunuity to think about the physics before the lecture, and come to class better prepared.

Weekly Homework

In addition to the daily homework, a written weekly problem set (usually consisting of 2 or 3 problems) will be due in class each Monday. Please make an effort to write solutions that are coherent and clear as well as correct. These problems will be graded according to the following guidelines:

5: a good effort with correct results *and* reasoning;
4: a good effort with minor errors, or a fair effort with no conceptual or math errors;
3: a good effort with modest conceptual errors and/or math errors, or a fair effort with minor errors;
2: a fair effort involving modest conceptual errors, or a good effort involving serious conceptual errors;
1: a poor effort;
0: no initial effort.

Up to 3 additional points to be given for presentation, so that each problem is graded out of 8. A good effort involves at least *some* English explanation and/or use of appropriate diagrams along with calculations, and/or some recognition of an implausible result. Be sure to write something for every part of a problem, even if only to indicate where you may be stumped.

Corrections

Up until one week after each weekly problem set is due, you may use the posted solutions (online, on Mastering Physics) and a red or colored pen to turn in a *corrected version* of any problem, even if you did not submit an initial effort. Be sure to correct effort deficiencies as well as math or conceptual errors. Your corrections will be evaluated on 2-point scale:

2: everything is suitably corrected;
1: some items remain uncorrected;
0: major issues remain uncorrected.

These correction points will be added to your initial score to yield your final score for that problem (up to a maximum of 8).

Guidelines for Problem Sets

For presentation:

1. Solutions should be written in complete and proper English.
2. Proper units must accompany all final numerical results.
3. Draw diagrams whenever possible, and label them clearly.

In general:

4. Do not insert numerical values until the *final step* in a calculation.
   (Physics is learned symbolically. If you simply insert numbers at the start of a calculation and crunch away, nothing will ever make sense.)
5. Regarding significant figures: *Do not round the results of any intermediate calculations … ever!* Leave at least three significant figures when reporting numerical results.
6. Form the habit of checking the dimensions of any equations that you derive. Many times, this simple exercise will reveal whether you made an error somewhere along the line.
7. If applicable, ask yourself whether an answer makes sense.