Date Board Approved:
(Prior to Fall 2003)

Date Prepared/Revised: 03/30/04

**This is an important document. Keep it! In the future, it could save you TIME AND MONEY!**

**Iowa Central Community College**
**Science Department**

Iowa Central Community College

# Course Syllabus

Course Name: Classical Physics I (Physics 1)
Course Number: PHY-212 (PHY-161)

Class Location and Time:
Room: SC-302 Day: MWF Time: 3:00 pm – 4:00 pm
Room: SC-302 Day: T, Th Time: 2:20 pm – 4:30 pm

Course Start Date: 9/1/2010 Course End Date: 12/15/2010

Instructor: Carl Gross
Office Location: SC-301A

E-mail Address:
gross_c@iowacentral.edu

Phone: (515) 574-1227, or
800 362-2793, x 1227

Office Hours:
Days: MWF Times: 9:10 am-10:10 am
Days: TR Times: 12:10 pm – 1:10 pm
Days: Times:

Final Exam: Day: Wednesday Date: December 15, 2010 Time: 3:00 pm – 4:30 pm

Departmental Assistance: For help with course selection, class registration, transfer information, and other academic assistance, please contact the department associate, Jenny Williamson, in Science 110H, at (515) 576-7201, ext. 2503 or 1-800-362-2793, ext. 2503, or by e-mail: williamson@triton.iccc.cc.ia.us

1. Total Semester Hour Credit: 5

2. Total Contact Hours per Semester: Lecture: 72 Lab: 36 Clinical:

3. Catalog Description:
   This course is designed to meet the needs of students planning to major in engineering and various fields of science. Topics covered include elementary mechanics, including kinematics and dynamics of particles; work and energy; linear and angular momentum; rotational motion; oscillations; waves and gravitation.
   Prerequisite: MAT-210 Calculus I or equivalent

4. Prerequisites and/or Co-requisites:
   MAT-210 Calculus I or equivalent

5. Textbook Required:
   - Young & Freedman. *University Physics.* 12th edition. Addison-Wesley, 2008. ISBN-13: 9780805321876

6. Supplemental Materials Required:
   - Calculator with trigonometric functions – minimum
     - Programmable graphing calculator (Ti-86 or higher) – recommended
   - Laboratory notebook – any notebook with non-removable pages

- USB flash drive

**7. College Procedures:**

- **Children in the Classroom:**
  - Students are not allowed to bring children into the classrooms, labs, shops, or hallways during class times.
- **Electronic Devices in the Classroom:**
  - Cell phones, pagers, timers and similar devices are not to be operational during classroom, lab, and clinical times.
- **Inclement Weather Statement:**
  - The final decision to attend college classes can only be made by the individual based on their specific extenuating circumstances that may make it hazardous for them to travel.

8.*Additional Course Information:*

- Attendance
  - Attendance is required for success. Please be sure to attend class regularly. Refer to your student handbook for college attendance policy.
- Late Work
  - Is ***NOT*** accepted unless arrangements are made with the instructor **prior to the due date**.
- Make-up Work
  - Arrangements must be made with the instructor **prior to due date** if possible.
    - At minimum a phone call, e-mail, or Facebook message must be received by the end of the day to be eligible for make-up work.
  - When available, make-up work will likely be different from in-class versions.
  - Make-up work will be evaluated on a case-by-case basis.
  - Missed presentations can't be made up unless arrangements are made **at the time the presentation is assigned**.

9. *Grading Policy*:

| Letter Grade | Minimum Percent |
|---|---|
| A | >90 |
| B | >80 |
| C | >70 |
| D | >60 |
| F | <60 |

| Grade Weighting | |
|---|---|
| Homework | 30 |
| Quiz | 20 |
| Lab Work | 20 |
| Midterm | 15 |
| Final | 15 |

10. Course (Student) Outcomes:
    - The student will have a basic understanding of important physics principles outlined below.

11. Unit (Competencies) Outcomes:

Outcome 1: Understand the SI system of measurement, error analysis and the use of vectors.

- Task 1: Write the base units for mass, length, and time in SI units.
- Task 2: Define and apply the SI prefixes that indicate multiples of base units.
- Task 3: Convert from one unit to another unit for the same quantity when given the necessary definitions.
- Task 4: Determine whether or not an equation is dimensionally correct.
- Task 5: Apply the rules of significant figures and represent an answer with the correct number of significant figures.
- Task 6: Define a vector quantity and a scalar quantity and give examples for each.
- Task 7: Describe a vector in terms of components and unit vectors.
- Task 8: Solve vector problems using geometric constructions and arithmetically by either plane trigonometry or component addition.
- Task 9: Solve problems concerning dot & cross products of vectors and give examples of their physical significance.
- Task 10: Quantify and minimize sources of random uncertainty so that the precision of measurements can be enhanced.
- Task 11: Compensate for systematic error in measurements so that accuracy can be improved.

Outcome 2: Understand and apply the laws of motion in one, two, and three dimensions.

- Task 1: Define and give formulas for displacement, average speed, average velocity and average acceleration.
- Task 2: Solve problems involving time, displacement, average velocity, and average acceleration in both one, two, and three dimensions.
- Task 3: Apply one of the general kinematic equations for uniformly accelerated motion to solve for one of the five parameters: initial velocity, final velocity, acceleration, time, and displacement.
- Task 4: Plot graphs of displacement vs. time, velocity vs. time, and acceleration vs. time. Use any graph to determine the shape of the other two graphs and be able to determine instantaneous velocity, average velocity, instantaneous acceleration, average acceleration, and displacement from graphs.
- Task 5: Recognize how graphs can be used to describe changes in position, velocity, and acceleration of an object moving along a straight line.
- Task 6: Solve acceleration problems involving free-falling bodies in a gravitational field.
- Task 7: Explain with equations and diagrams the horizontal and vertical motion of a projectile launched at various angles.
- Task 8: Determine the position and velocity of a projectile when its initial velocity and position are given.
- Task 9: Determine the range, the maximum height, and the time of flight for a projectile when the initial velocity and angle of projection are given.

Task 10: Determine the velocity, acceleration, and period of revolution of a particle moving in a circle.

Outcome 3: Understand the relationship between the forces applied to an object and the motion that results.

Task 1: Describe the relationships among force, mass, and acceleration and give the consistent units for each.

Task 2: Demonstrate by definition and example your understanding of the distinction between mass and weight.

Task 3: Draw a free-body diagram for objects in motion with constant acceleration, set the resultant force equal to the total mass times the acceleration, and solve for unknown parameters.

Task 4: Identify the force pairs acting in a system.

Task 5: Describe the properties of friction and explain why the coefficient of static friction is greater than the coefficient of kinetic friction.

Task 6: Solve friction and frictionless problems for any of the following: force (or force component forces), mass, acceleration, tension, coefficients of friction, or inclined plane angles.

Task 7: Examine a variable force system such as suspended masses on a spring. Using different masses, determine the resulting displacement. Graph force vs. displacement. Determine the spring constant k from the graph and derive $W = \frac{1}{2} kx^2$.

Outcome 4: Understand the concepts of energy conservation and energy and work relationship.

Task 1: Define and write mathematical formulas for work, potential energy, kinetic energy, and power.

Task 2: Calculate the work done by constant and variable forces.

Task 3: Discuss and solve problems concerning the relationship between the performance of work and the corresponding change in kinetic energy.

Task 4: Solve problems involving the concept of kinetic energy and its relationship to the net work done on a point mass as embodied in the work-energy theorem.

Task 5: Discuss and solve problems concerning the principle of conservation of mechanical energy.

Task 6: Determine the power of a system and understand its relationship to time, force, distance, and velocity.

Task 7: Relate conservation and non-conservative forces to the net work done by a force when an object moves in a closed loop.

Outcome 5: Understand the concepts related to systems of particles and collisions. The concepts will include center of mass, impulse, linear momentum, and elastic and inelastic collisions.

Task 1: Evaluate the linear momentum of a system of particles.

Task 2: Find the Center of Mass of a system of particles and of a continuous object.

Task 3: Define and give examples of impulse and momentum as vector quantities.

Task 4: Write and apply a relationship between impulse and the resulting change in momentum.

Task 5: Distinguish by example and definition between elastic and inelastic collisions.

Task 6: In a system involving two objects where linear momentum is conserved, calculate the velocity or mass of either object if pertinent masses and velocities are given. Consider both elastic and inelastic collisions; and when only one body is initially moving or when both bodies are initially moving.

Task 7: State the law of conservation of momentum and apply it to the solution of physical problems.

Outcome 6: Understand and apply the laws of motion relating to circular and rotational motion.

Task 1: Define and apply the concepts of frequency and period of rotation, and relate them to the linear speed of an object in uniform circular motion.

Task 2: Solve problems requiring the knowledge of centripetal force including banking angles, the conical pendulum, and motion in a vertical circle.

Task 3: Define and apply the concepts of frequency and period of rotation, and relate them to the linear speed of an object in uniform circular motion.

Task 4: Define angular displacement, angular velocity, and angular acceleration, and apply these concepts to the solution of physical problems.

Task 5: Draw analogies relating rotational-motion parameters ($\vartheta$, $\omega$, $\alpha$) to linear-motion parameters (d, v, a), and solve angular acceleration problems.

Task 6: Define the moment of inertia of a body and describe how this quantity and the angular speed can be used to calculate rotational kinetic energy.

Task 7: Apply the concepts of Newton's second law, rotational work, rotational power, and angular momentum to the solution of physical problems.

Task 8: Write and apply the relationships between linear speed or acceleration and angular speed or acceleration.

Task 9: Compute the angular momentum about any center of a particle or system of particles.

Task 10: Compute the torque produced by a given force about a given center.

Task 11: Solve problems using the Law of Conservation of Angular Momentum.

Outcome 7: Understand the concepts related to oscillations and simple harmonic motion.

Task 1: Write and apply formulas for the determination of displacement x, velocity v, and acceleration a in terms of time, frequency, and amplitude.

Task 2: Provided a graph or verbal description of simple harmonic motion, determine the frequency, period and amplitude.

Task 3: Compute the frequency or period in simple harmonic motion when the position and acceleration are given.

Task 4: Write and apply a relationship between the frequency of motion and the mass of a vibrating object when the spring constant is known.

Task 5: Describe the motion of a simple pendulum and calculate the length required to produce a given frequency.