Physics 201 Syllabus

The motion of idealized systems

David J. Ulrich

Winter 2013

CRN	10800 and 11759 (3 credits)
Date/Time	Mon, Wed at 6:00–8:50 pm
Campus	PCC Rock Creek Bldg 7
Room	Room 223 and 225
Instructor	David J. Ulrich
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Office	Building 7, Room 202
Office Hours	After class

Course Overview

This course will cover such topics as projectiles, statics, Newton's laws, energy, collisions, circular motion and rotational dynamics. In addition, we will touch on some subjects related to celestial dynamics and general relativity as time allows.

Our textbook will be *Physics (8th edition)* by Cutnell and Johnson. We will be covering Chapters 1–9 in this course.

The Course Content and Outcome Guide can be obtained online via the following hyperlink: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=PHY&course=201. This includes more course detail and outlines the course prerequisites.

Each Monday session will be held in Room 223. This room contains the material used for the labs. Therefore labs will fall on the Monday meetings. The Wednesday sessions will consist solely in lecture and will be held in Room 225.

Intended Outcomes

After completion of this course, students will

- Apply knowledge of linear motion, forces, energy, and circular motion to explain natural physical processes and related technological advances.
- Use an understanding of algebraic mathematics along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
- Design experiments and acquire data in order to explore physical principles, effectively communicate results, and critically evaluate related scientific studies.
- Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.

Grading Scheme

Your total grade will be a weighted average of all the assignments in class. The weight for each category of assignments is in the following table.

Category	**Weight**
Weekly Quizzes	20%
Lab Participation	20%
Lab Write-Up	20%
Written Report	20%
Final Exam	20%

Weekly Quizzes

I will assign weekly homework assignments but I will not grade them. However, the quiz problems will be similar to these problems so it is in your best interest to do them when assigned. These assignments are available on the website. The answers and some of my solutions are also available. Use these materials as you see fit.

The first half-hour of each Monday will be used for a short quiz. Although these problems may be taken from sources other than the homework, they will be comparable to them both in terms of content and difficulty level. These quizzes will be *open* book.

Lab Participation

The lab worksheets are available on the website. Please bring your own copy to work on. You will be required to record your data and observations, answer the questions, and return them to me before you leave. There will be no take-home work required with the labs. Only those present

will receive credit for participating. There will be no make-up labs, but I will allow you to drop one as necessary. You will not be allowed to make up work by attending other physics classes.

I do have one pet-peeve regarding these labs. "Human error" is not another way of saying "I have no clue". When I ask for "sources of error", reinterpret that to say "if I had to do this again, what would I do to improve the experiment?"

Lab Write-Up

I will expect a formal write-up of *one* lab from a set of labs I specify. At a minimum this write-up must allow the reader to reproduce the experiment. In all cases these labs are rather qualitative in nature. I expect you to add at least one significant element to improve the quality of the experiment: tighter controls, more distinct trials, data graph, error analysis, etc.

A well-documented intent, procedure, data record, error analysis, and conclusion are all expected elements of the write-up. Here are the questions I will consider as I grade them:

- Is there a basic understanding of the lab?
- Is the data recorded clearly?
- Is the procedure reproducable?
- Is the theory correct?
- Is the analysis correct? (math/logic)
- Are sources of error identified correctly?
- Is the error propagation calculated correctly?
- Does the conclusion follow from the data?
- Are the future improvements thoughful?
- Is the look and feel professional?

Written Report

This report is to be 5 to 7 typed pages in length. I would prefer for you to find some physics application within your chosen field of study. For example, a nursing student may choose ultra-sound, or a micro-electronics student may chose VLSI technology, etc.

It may be that you either don't have a chosen field of study yet, or perhaps just have a strong interest in some physics subject (e.g., the atomic bomb) or personality (Richard Feynman). You may choose these as topics also.

At the end of week three, I expect you to turn in an outline of your chosen topic and paper. At the end of week six, you must turn in a rough draft. The final draft will be due the last day of class. One-third of this portion of your grade will be allocated for each of these sub-assignments.

Final Exam

See the class schedule for the date of the final exam. The questions will be primarily taken from the previously assigned homework assignments and quizzes. The exam will be *closed* book. You will be allowed to bring at most a 8.5“ by 11” page of handwritten notes. If you need help remembering an equation or the value of some constant during the exam, I will certainly be willing to tell you—please don't hesitate to ask. You will be given the entire three hour period.

See http://www.pcc.edu/resources/academic/standards-practices/ for more detail on PCC Grading Guidlines.

Miscellaneous

Attendance and make-up policies Attendance is required for any lab, quiz, or exam. The instructor reserves the right to administer or refuse to admininster any make-up work for lack of attendance.

Instructional ADA statement If you require specific instructional accommodations, please notify me early in the course. A request for accommodation may require documentation of disability through the Office for Students with Disabilities at 977-4341.

Code of student conduct Information may be found through this http://www.pcc.edu/about/policy/student-rights/.

Academic integrity statement Students are required to complete this course in accordance with the Student Rights and Responsibilities Handbook. Dishonest activities such as cheating on exams and submitting or copying work done by others will result in disciplinary actions including but not limited to receiving a failing grade. See the Academic Integrity Policy for further details: http://www.pcc.edu/about/policy/student-rights/.

Flexibility statement The instructor reserves the right to modify course content and/or substitute assignments and learning activities in response to institutional, weather, and class problems.

Withdrawal policy As the student, it is your responsibility to process a Drop via the Web or at a Registration Office within the specified time periods set forth by PCC. Deadlines can be located at http://www.pcc.edu/registration/dropping.html.

Class Schedule

This following schedule should be considered tentative. In particular, based on class progress, we may slow down or speed up the lecture schedule.

Wk	Day	Date	Description
1	Mon	Jan 7	Lecture 1–2: Class Details, Introduction
1	Wed	Jan 9	Lecture 3: Kinematics
2	Mon	Jan 14	Lab: Free-Fall and Projectiles
2	Wed	Jan 16	Lectures 4–5: Vectors, Equilibrium
3	Mon	Jan 21	Campus Closed
3	Wed	Jan 23	Lecture 6: Newton's 2nd Law
4	Mon	Jan 28	Project: Air Drag Simulation
4	Wed	Jan 30	Lectures 7–8: Uniform Circular Motion, Gravity
5	Mon	Feb 4	Lab: Centrifugal Force
5	Wed	Feb 6	Lecture 9: Torque and Equilibrium
6	Mon	Feb 11	Lab: Simple Machines
6	Wed	Feb 13	Lecture 10–11: Kinematics of Rotation, Torque and Rotation
7	Mon	Feb 18	Lab: Spinning Disks
7	Wed	Feb 20	Lecture 12–13: Machines and Work, Energy
8	Mon	Feb 25	Lab: Rolling Things
8	Wed	Feb 27	Lecture 14–15: Momentum, Simple Collisions
9	Mon	Mar 4	Lab: Air Cart Collisions
9	Wed	Mar 6	Lecture 16–17: Beyond Collisions, Celestial Mechanics
10	Mon	Mar 11	Project: Apollo 11
10	Wed	Mar 13	Lecture 18: Bending Time
11	Mon	Mar 18	Final Exam

Course Content

- FUNDAMENTALS OF MEASUREMENT
  - Demonstrate the use of the metric system.
    - Units of the "SI" system
    - Conversion of units
    - Prefixes, from very small to very large
  - Use the concept of "significant figures."
    - In laboratory measurement
    - In calculations and problem solving
  - Use vectors in calculations
    - Vectors and scalars
    - Components of vectors
    - Graphical solutions to vector problems
    - Analytical solutions to vector problems
- ACCELERATED MOTION
  - Distinguish speed from velocity and solve appropriate problems involving these concepts.
  - Define uniform acceleration.
  - State the equations for uniformly accelerated motion and understand their derivation. Solve problems involving these equations.
  - Explain the phenomenon called "free fall" and that it is a special case of uniformly accelerated motion.
- NEWTON'S LAWS
  - Explain Newton's First Law of Motion and its applications.
  - Explain Newton's Third Law of Motion and to be able to apply it.
  - Explain Newton's Second Law of Motion and its application. This must include the definition of force, of weight and how it is related to mass, of inertia and how they relate to acceleration.
  - Develop the ideas of Newton's Law of Gravitation, with emphasis on its being an inverse square law.
  - Delineate the role of friction forces in motion problems.
- WORK AND ENERGY
  - Define work and solve problems involving this quantity.
  - Define power and solve problems involving this quantity.
  - Define energy.
  - Define kinetic energy (KE) and solve problems involving this quantity.
  - Explain gravitational potential energy (GPE) and solve appropriate problems. Relate GPE and KE in specific cases, for example, a swinging pendulum.

- MOMENTUM
  - Explain the concept of linear momentum.
  - Grasp the nature of and importance of conservation as a physical principle. Develop the conservation of energy, of mass, of mass-energy, and especially of linear momentum.
  - Restate Newton's Second Law in order to understand the phenomenon called impulse.
  - Delineate elastic and inelastic collisions and use these ideas in the solution of appropriate problems.
- ROTATIONAL MOTION
  - Study via analogy with linear-motion the concepts of angular distance, angular velocity, angular acceleration.
  - Learn a set of angular-motion equations by analogy to the linear-motion equations previously studied.
  - Discuss tangential speed, velocity and acceleration.
  - Study centripetal force.
  - Apply the above concepts to orbital motion.
  - Develop an understanding of projectile motion and to solve appropriate problems.
- MOTION OF RIGID BODIES
  - Explain the equilibrium of a point object.
  - Define torque and solve problems involving this phenomenon.
  - Study the conditions for rotational equilibrium and apply this knowledge.
  - Define the center of gravity.
  - Study the analogy of torque and angular acceleration to force and linear acceleration.
  - Develop an understanding of the conservation of angular momentum.