

University Physics II - An Introduction to
Electricity, Magnetism, and Optics - Instructor's
Guide

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Chapter 1

Introduction

In 1995, the University of Arkansas received a grant from the National Science Foundation to revise its introductory physics program. University Physics II(UPII) is the product of that revision and 10 years of refinement. This site contains all materials required to field a complete semester of UPII including all homework, quizzes, labs, lectures, and tests. This document presents the implementation details of UPII. For educational philosophy and design philosophy see the course design document.

Chapter 2

Class Structure

The class is designed to provide as much one-on-one student to teacher time as possible. To do this, only two hours of lecture on Monday and Wednesday are presented, instead of the normal three hours a week. Two lab sessions are presented each week, each two hours in duration. Labs meet Monday/Tuesday and Wednesday/Thursday. Friday is used for a one-hour staff meeting.

2.1 Lecture

Lecture meets twice a week, Monday and Wednesday, before the first lab of the day. With only two 50-minute lectures a week, time is at a premium and enrichment activities like demonstrations and video are not used. This is a conscious design decision that it is better to just spend less time in lecture rather than trying to enrich it. Most physics demonstrations are really not very good entertainment. All demonstrations are performed in lab where the student can try them and ask questions in a small group setting if they wish. Complete lecture notes are included with this site. The notes are marked with boxed text representing things that are said and un-boxed text things that are written. Since all course material is covered in the course reading, a lecture that does not finish because of student questions or differences in instructor pacing is not a problem because the student can be referred to the reading.

2.2 Lecture Quiz

To ensure attendance, a quiz question is given at the beginning and end of lecture. In our implementation the question is placed on an overhead and the students turn in a single paper with the answer to both questions. The question at the beginning is placed on the overhead as students enter, encouraging timeliness. The beginning question tests over the reading or some important concept in the homework. This question is left up for a couple of minutes after

class begins while the instructor make announcements, takes questions, and introduces the number of the day. The question at the end of lecture covers some simple application of the material presented in lecture and tests whether the students are paying attention.

2.3 Reading Assignments

Students are asked to read the material for lecture before they come to lecture. Self-test questions over the reading are included in each homework. Since homework is required each lecture period, the assignment is included at the top of the homework assignment.

2.4 Laboratory

Lab starts with a lab quiz to ensure punctual attendance. The quiz is about five minutes long. At the end of the quiz time, the solution to the lecture quiz is presented. The lab quiz solution is then presented. We print both on overheads. A brief introduction to the lab is presented by the TA (detailed in the Lab notes for each lab) and any demonstrations presented. The students begin working on the activity. The TA moves around the lab answering questions and talking to students. The atmosphere is fun and relaxed. As lab groups finish, the TA looks through their work and discusses any errors or particularly astute insights with the group. The TA signs the lab manual and the group gets full credit for the lab. This grading method ensures that each group discusses the relevant physics in a setting of no more than 4 students for each lab.

Students also grade the homework just collected in lab. Solution keys are provided with detailed grading instructions. The student grading is spot checked by the TA. This system ensures the student looks at the solution and does so in an environment where they can ask questions of an expert.

The students do 28 activities over the course of the semester. Parts of four of these activities are analyzed for lab reports.

2.5 Lab Quiz

At the beginning of each lab, a lab quiz is given. This test over the students mastery of the homework. The quiz lasts about 5 minutes. Pre and post test and surveys are also given as lab quizzes.

Chapter 3

The Course Site

The student's primary resource for addressing the course is the course web site. The site contains all course readings, homework assignments, practice tests for each exam, an example of the final, and solutions to all assignments. The activity guide for the lab is not provided on-line and must be purchased from the bookstore. Some students prefer to have a printed version of the course notes. A printable version is provided with the distribution.

3.1 Course Readings

The course readings are available by chapter at the web site. A set of assigned reading and a study guide is provided for each chapter. The chapter is also subdivided into skills, a rough division of the new skills a student has to master to have learned the material in the chapter. The skills include relevant information and a list of published examples.

3.2 Assignments

Homework assignments are collected every lecture day and are available after the course chapters. As the homework is graded, the solution is provided through the link [Solution] next to the assignment. Practice tests from each exam are provided along with solutions. The lecture and lab quizzes and their solutions are provided next so the student can review them for the exam. The quizzes and solutions are enlarged so they can be projected on an overhead projector.

3.3 Grades and Syllabus

At the bottom of the left index is a link for connecting to a student grade site and a link to the course syllabus. Specialized software exists for managing a

grade site linked to the course site but is not yet ready for broad release. We would be interested in sites that wish to beta-test grade software.

3.4 Timed Release

Solutions and assignments have to be released on schedule. This site contains the Tuesday and Thursday releases for an entire course. These should be released after the last lab grades their homework.

3.5 Instructor Site

The instructor site, the site first accessed through the distribution disk, contains additional material not available to students. This disk contains lecture notes for each lecture. The lectures are numbered from the first day of class and a lecture is given each class day. The lectures are timed and numbered with the activities. This site also contains lab notes: lecture and discussion to present at the beginning of lab and activity solutions.

Chapter 4

Grading

The grading load for UPII is two lab and two lecture quizzes a week, usually graded by student helpers, 21 homework sets graded by students with about half spot checked by TAs, four tests graded by TAs and the lead instructor, and four lab reports graded by the lab instructor.

4.1 Scaled Grading

Eventually, UPII assignments will be assembled out of a base of problems. This is already being done at the University of Arkansas, but the method still requires refinement. As such, all problems are assigned points based on their natural grading scale. As assignments are assembled out of these problems the total for the assignment rarely adds up to the same number each time. Therefore, all grades are scaled by computing the percent of the assignment that was correct and multiplying by the total real points toward the class the assignment was worth. For example, Monday homework assignments count 10 points toward the class. The first assignment may be graded out of 36 points, its natural scale. If a student received 18 of the 36 points, they would earn $18/36 * 10 = 5$ points toward the class

4.2 Assigning Points

Points are assigned so as to be the minimum possible for each type of assignment so that the student actually does the assignment. Real evaluation of the student is the responsibility of the test. With all these assignments, it is hard to give enough points to each while still maintaining enough motivation for the students to do a good job. We have solved this in two ways. Activities that are not complete receive a negative grade (our lab attendance is approximately perfect). Homework and lecture quizzes earn drop points toward the exam. Students really like to drop one exam. It helps greatly with the management of pressure in a science class. It is however very disruptive as good students decide to drop

the fourth test and not to work the last three weeks of the semester. We solve this by allowing the students to earn drop points which can be applied to a bad hourly exam or part of the final. The student earns one drop point for each homework point they score and one drop point for each lecture quiz they score something on. This rewards students who work along and weights the final exam more heavily for students who don't.

Chapter 5

Managing Teaching Assistants

Teaching assistants come to college with a variety of backgrounds. Many TAs are not fully a master of the physics in an introductory course but think they are. For the course to function, a TA must be required to master the appropriate physics. TAs also have limited instructional experience and need detailed examples of good instructional technique. All TAs at the University of Arkansas physics department receive a week of TA training before entering the university. This is not nearly enough training.

5.1 Preparation

TAs are asked to work the activity and the next week's homework and bring it to the lab meeting. Both are checked by the lead instructor. This allows the instructor to correct presentation and talk the TA through the physics.

5.2 Mentoring

This is not enough for a beginning TA. They need to see how the material is actually presented and to see what kinds of problems arise in lab. New TAs are asked to attend the first lab which is taught by the lead instructor. They watch the presentation and help the students, asking questions as they encounter problems. This system has worked extremely well and is the key to creating a quality educational product in all lab sections.