PS 160 – Physics II for Engineers
Embry-Riddle University
Spring 2007

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Required text: Principles of Physics, 4th edition, by Serway & Jewett
Supplementary: any calculus-based physics textbook, choose one you like
Understanding Physics, by Asimov
Cartoon Guide to Physics, by Gonick & Huffman

Grading:	12%	problem sets	*Grading scale*:	A	90 – 100 %
	66%	3 exams (22% each)		B	75 – 90 %
	22%	two-hour final exam		C	60 – 75 %
	~8%	*challenge work*		D	50 – 60 %

Problem Sets: Assigned weekly, and due at the beginning of class. Graded for correctness. Late work will not be accepted.
Exams: 3 one-hour exams (Feb 8/9, Mar 8/9, Apr 12/13). No make-ups.
Final exam: Tue 1 May, 8:00 am – 10:00 am. Two-hours. Comprehensive.

Holidays: Mon, Jan 15 (Martin Luther King day)
Mon, Feb 19 (President's day)
Mon-Fri, Mar 19-23 (Spring break)

IMPORTANT NOTE

Listening to lectures is not enough (*you retain only 10% of what you hear* …). All processes of learning are somehow connected to active participation, and the learning of physics is no exception. Therefore, it is imperative that you work diligently at your own desk (… *80% of what you practice* …). However, this does not mean that you should only work alone. I encourage you to form study groups and collaborate with your classmates (… *and 90% of what you teach to others!*).

Course Description: Gravitation. Simple harmonic motion, waves, fluids, heat, kinetic theory, thermodynamics. Geometrical optics. **Prerequisite**: PS 150. **Corequisite:** MA 242.

Goals: This course is the second of a three-semester course sequence of introductory classical physics for students in engineering programs. It is designed to provide the student with an appropriate background for more advanced physics and engineering course work. It is required that the students have a working knowledge of beginning calculus.

Prerequisite Knowledge:

1. Basic algebra and applications.
2. Exponential and logarithmic functions, and related mathematical manipulations.
3. Trigonometric functions and identities as well as their applications.
4. Basic calculus. Applications of differential and integral calculus.
5. Familiarity with scientific notation.
6. Knowledge and practice of analytic tools for solving word problems.
7. Newton's laws of motion and applications.
8. Work, mechanical, kinetic and potential energies.
9. Conservation of momentum and energy.

Learning Outcomes:

1. Be able to solve problems using Newton's law of gravity.
2. Define simple harmonic motion. Derive and use to solve problems, the basic relationships involving simple harmonic motion.
3. Be able to describe various types of wave motion and explain superposition and interference. Be able to solve problems involving the Doppler Effect, standing waves and natural frequencies.
4. Demonstrate your understanding of Pascal's and Archimedes' Principles by solving hydraulic and buoyancy problems. Derive and solve problems with Bernoulli's equation for streamline flow.
5. Define temperature and the absolute temperature scale. Solve problems concerning thermal equilibrium, thermal expansion, heat capacity, heat conduction, the mechanical equivalent of heat, the First Law of Thermodynamics.
6. Understand the Kinetic Theory of Gases. Know the ideal gas law, kinetic interpretation of gas temperature and internal energy, and molar specific heats.
7. Define entropy. Solve problems involving reversible and irreversible processes, Carnot Cycle, Second Law of Thermodynamics, engine and refrigerator efficiencies; evaluate entropy changes.
8. Know the difference between geometrical optics and physical optics. Be able to use the ray method and draw ray diagrams using the four basic rays. Define the index of refraction and realize that it depends on wavelength. Be familiar with $v = f\lambda$. Know why waves refract and be able to apply Snell's law to solve problems.
9. Be able to calculate image, object distances and focal lengths for concave and convex mirrors and thin lenses. Be able to use the lensmaker's equation in solving problems. Be able to analyze and solve systems with more than one lens, using ray diagrams and equations. Know how to apply this to instruments like the camera and telescope. Know that light intensity drops off as $1/r^2$ and the units for light intensity.

Code of Behavior

In order for learning to take place, we all must act with civility (formal politeness) and respect (polite consideration, courtesy) toward each other. My responsibilities include coming to class prepared and on time, and evaluating you in a fair and impartial manner. Your responsibilities include coming to class prepared and on time, not disrupting the class (for example, talking without being called on, eating, reading newspapers, sleeping, shuffling papers, talking on cell phones, etc.), and treating your fellow students as colleagues (see the Student Handbook). Violations of this code can result in your removal from the class.

Academic Integrity

Issues of academic integrity are discussed on page 24 of the Student Handbook. They include plagiarism, cheating and fraud. Please read this section, and if you do not understand it, come see me. Some important passages are reproduced here:

"Sanctions [for academic dishonesty] may include failure of a test or assignment, failure of a course, suspension, or dismissal from the University."

"Plagiarism is recognized by the University as an act of academic dishonesty. It is defined as taking the ideas, writings, work, and/or words of another and representing them as one's own."

Office hours

I am always in my office during my office hours, and this is your time to speak with me about any aspect of the course. Also, I am generally in my office between 9 am and 5 pm, and available at times other than my office hours. However, I may be teaching or doing research, and may not be available immediately. If you need to speak with me, drop by or call me and set up an appointment.

Attendance

Class attendance is strongly encouraged. If you miss a class you are still responsible for the material presented in lecture. Make friends with your classmates, and know what has been discussed.

Reading

The textbook is your primary source of information – not lecture. If you don't like the assigned text, find one that you do like (they are all essentially equivalent) – check one out of the library or buy one from a used bookstore. Reading the text is mandatory and is to be done *before* each class. It is extremely important that you come to class prepared to think and discuss the day's topic. Not knowing that topic is a serious detriment to learning. The schedule is listed at the end of this syllabus. *How* to read the textbook is suggested below.

Notes

Taking notes during lecture is important – but you must review and re-copy those notes after class (within a few hours) for them to be useful. Notes that are never reviewed are less than worthless: they give you a false sense of security. It is important that you get into the habit studying every day.

General study habits

Repetition is critical for creating long-term memories. A good method for learning is the following sequence: read, listen, write, re-read, re-write, practice, and review. The textbook should be read THREE times: read once before class, read deeply (at least) once after class, and once as a review. In addition, you do not read textbooks as you would the newspaper. You must work through the examples, all mathematical steps should be confirmed, and you should write notes in the margins (it is your book, you can write in it!).

Problem Sets

Several basic problems will be assigned each week, but these are NOT to be turned in. They are for your practice only. In addition, the solutions to 2-3 advanced problems will be due at the beginning of the class period on the due date. Each solution will be graded on a scale of 0 to 10. These problem sets are **critical** to your success in this course. Not only are they worth 12% of your grade, but also because the exam problems will be very similar to the homework problems, and solving the problems well will boost your exam performance. I suggest that you solve other problems as well, as practice for the exam, and most of the problems in the text are good for this.

In order to obtain full credit for each problem solution, you must solve it according to the following rules of coherence and readability:

- Describe *briefly*, but in clear and complete sentences, the basic principles used to solve the problem and explain the basic equations that are used in the solution [DO NOT simply rewrite the question]. This is the most important component of coherence and full credit will not be given for any problem solution that does not contain such a description.
- If a physical situation is discussed in the problem, draw an appropriate diagram.
- Identify in words, or by clear references to the diagram, all the symbols you use.
- Work through the problem symbolically, getting a simplified symbolic answer, and only substitute numbers (if appropriate at all) at the very end.
- If you obtain an explicit numerical solution, comment on whether the value you get is reasonable.
- Put boxes around your final answers.
- Write up the problem sets neatly.

Do not simply copy another student's work (see the statement about plagiarism above), and do not simply copy from the solutions manual, but I recommend that you form study groups and work together. This can help you through difficult sections and problems. I encourage you to discuss, argue, arm-wrestle, and finally master the problems. However, I expect you to write up your solutions individually, showing your own insights.

Finally, the problem set solutions must be neat, stapled, and have your name clearly written. Unstapled solutions will not be graded. Unreadable solutions will not be graded.

Exams

3 one-hour in-class exams, and one two-hour final exam will be given. All exams are closed book and closed notes. An excellent method to prepare for the exams is to attempt problems at home in an exam-type environment. That is, once you have solved a group of problems, put aside the solutions and pretend that they are questions on an exam – attempt to solve them again, but without any help. If you can do this with several problems from each chapter, you should do fine on the exams.

Challenge Work

Two types of challenge work can be turned in for extra credit.

First, I will hand out a list of challenge problems. You may turn in one solution per week. These problems are more difficult than the problem sets in that they usually require a synthesis of many of the concepts and techniques that you have learned. Each correct challenge problem will count for 25% - 50% of one problem set.

Second, I will hand out three articles, written by physicists of the past. You are to read the article and write a short (1-2 pages, single spaced, minimum 500 words) report, detailing how the article relates to what you have learned in class. You are NOT to write a biography of the physicist, nor simply repeat what is in the article, but *relate* it to the class material. You may hand in one report before each exam, and credit will be equivalent to one problem set.

Grading System

From page 26 of the Student Handbook: "The following grades are used by the faculty to indicate the quality of work performed." (*I have added my own interpretations in italics.*)

A = Superior (*Performance of the student has been of the highest level, showing sustained excellence in meeting course responsibilities*)
B = Above Average (*Performance of the student has been good, though not of the highest level*)
C = Average (*Performance of the student has been adequate, satisfactorily meeting the course requirements*)
D = Below Average (*Performance of the student has been less than adequate*)
F = Failure (*Performance of the student has been such that course requirements have not been met.*)

Contrary to popular belief, you *are* in the "real world" now. Your success in this course depends on you alone. You must be self-critical and determine the method by which you study best. Whatever method you use, I believe that success requires a minimum of **six (6)** hours per week **outside** of lecture. Come see me if you desire suggestions on time management, study hints, or anything that will help you succeed in this course.

You also need adequate sleep and exercise. If you don't get these, your body will not be able to function well (even though your mind is willing).
