PS 160 – Physics II for Engineers
Embry-Riddle University
Spring 2008

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Required text: *Principles of Physics*, 4th edition, by Serway & Jewett
Chapters 12-18, 25-27

Supplementary text: any calculus-based physics textbook, choose one you like
Understanding Physics, by Asimov
Cartoon Guide to Physics, by Gonick & Huffman

Point system:

1 final exam	200 points	200
3 tests	200 points each	600
120 problems	1 point each	120
30 quizzes	2 points each	60
3 group problems	10 points each	30
3 reports	10 points each	30
13 challenge problems	4 points each	52

Grading scale:

A	900 –
B	750 – 899
C	600 – 749
D	500 – 599

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

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 universal gravitation.
8. Work, mechanical, kinetic and potential energies.
9. Conservation of momentum and energy.

Learning Outcomes:

1. Define simple harmonic motion. Derive and use to solve problems, the basic relationships involving simple harmonic motion.
2. 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.
3. 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.
4. 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.
5. Understand the Kinetic Theory of Gases. Know the ideal gas law, kinetic interpretation of gas temperature and internal energy, and molar specific heats.
6. Define entropy. Solve problems involving reversible and irreversible processes, Carnot Cycle, Second Law of Thermodynamics, engine and refrigerator efficiencies; evaluate entropy changes.
7. 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.
8. 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.
9. Understand interference and Young's double-slit experiment. Calculate fringe locations for thin films and diffraction patterns.

RULES

1. Arrive on time; depart on time.
2. Take notes, and bring calculator to each class.
3. No eating, no cell phones.

Final Exam

Comprehensive; two-hour; closed book; closed notes.
Tools: pen or pencil, scientific calculator, 3x5 card (both sides) for equations.
Date: Tuesday, 29 April, 8:00 am – 10:00 am.

Tests

One-hour; closed book; closed notes.
Tools: pen or pencil, scientific calculator.
Dates: Wed 6 February, Wed 5 March, Wed 9 April.
Final exam will count for one missed test.

Problems

Ten sets; 12 problems each; must be neat and stapled.
Due Dates: approximately one per week.
Graded on correctness and effort.

Quizzes

First 5 minutes of each class.
Tools: pen or pencil, scientific calculator.

Group Problems

Three experiments; groups of 3-4.
Due Dates: 23 January, 20 February, 24 March.
Group report: one page, single-spaced; answer assigned questions.

Reports

Three reports on assigned articles.
Due Dates: 30 January, 27 February, 31 March.
One page, single-spaced, minimum 500 words; answer assigned questions.

Grading:	<500 words	-1 point
	<400 words	-2 points
	1-4 grammatical errors	-1 point
	5 or more errors	-2 points
	Each question not answered	-1 point

Challenge Problems

Due Dates: each Friday (18 January – 18 April).

All assignments are due at the *beginning* of class on the due date, after which they will be considered late and the score will be reduced by 50%. After the beginning of the *next* class period, they will not be accepted.

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!).

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.

Problem Solving

Solving problems is **critical** to your success in this course. 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. Solve problems 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].
- 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.

Study Groups

"For most individuals, learning is most effectively carried out via social interactions." (Ed Redish) I strongly suggest that you form study groups.