PS 160 – Physics II for Engineers
Embry-Riddle University
Spring 2009

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office hours: MWF 1:00-2:00, TTh 2:00-3:00 in Lehman 313
MW 4:30-5:30 at Starbucks

Required text: *Principles of Physics*, 4th edition, by Serway & Jewett
Chapters 12-18, 25-27 (except sections 13.6, 27.10)

Recommended: *Physics*, by Tipler – QC 21.2 .T548
Lectures on Physics, by Feynman – QC 23 .F47
"*Hyperphysics*" http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
"*Simple Nature*" http://lightandmatter.com/area1sn.html
Understanding Physics, by Asimov – QC 23 .A8
Cartoon Guide to Physics, by Gonick & Huffman – QC 24.5 .G66

Point system:

1 final exam	200 points	200
3 tests	200 points each	600
120 problems	1 point each	120
10-15 quizzes	2-4 points each	40
3 group experiments	10 points each	30
10 challenge problems	4 points each	40

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.

Topics to be covered

1. Oscillations and Waves
    a. Hooke's law, simple harmonic motion – mass on a spring, pendulum
    b. Damped, driven oscillations, resonance, stress, strain
    c. Traveling waves – vibrating string, sound, waves in solids, surface waves
        i. Transverse, longitudinal
        ii. Doppler-Fizeau effect
    d. Sound intensity, decibel scale, inverse-square law
2. Superposition, interference, diffraction, physical optics
    a. Standing waves in strings, organ pipes, beats, Fourier series
    b. Young's double-slit, thin films,
    c. Fraunhofer diffraction, Rayleigh's criterion
    d. Single-slits, diffraction gratings
    e. Bragg diffraction, Laue patterns
3. Fluid mechanics
    a. Pressure, Pascal's law, Archimedes' principle, buoyant force
    b. Laminar flow, continuity equation, Bernoulli's equation, drag
    c. Toricelli's theorem, Venturi tube, Pitot tube
4. Thermal physics, thermodynamics
    a. Temperature scales, absolute zero, thermal expansion, thermal equilibrium
    b. Kinetic theory of gases, Maxwell-Boltzmann distribution, equipartition theorem
    c. Ideal gas law, Vapor pressure, atmospheric lapse rate
    d. Calorimetry, heat capacity, latent heat, changes of phase, phase diagram
    e. 0th – 3rd laws of thermodynamics, mechanical equivalent of heat
    f. Conduction, convection, radiation, thermal conductivity, Stefan's law
    g. (Ir)Reversible processes, heat engines, refrigerators, Carnot cycle, entropy
5. Geometric optics
    a. Light intensity, inverse-square law
    b. Reflection, refraction
        i. Hero's law, Fermat's principle, Snell's law, Huygens's principle
        ii. Index of refraction, speed of light, dispersion
        iii. Total internal reflection, Brewster's angle
    c. Concave/convex mirrors, converging/diverging thin lenses, paraxial approx.
        i. Gaussian lens formula, lens-maker's formula
        ii. Ray diagrams, principal rays, focal point, focal length
        iii. Eyes, cameras, telescopes, microscopes

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, 28 April, 8:00 am – 10:00 am.

Tests

One-hour; closed book; closed notes.
Tools: pen or pencil, scientific calculator.
Dates: Fri 30 Jan, Fri 20 Feb, Fri 3 Apr.
Final exam will be the makeup for one missed test.

Problems

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

Quizzes

Take-home *and* in-class (first 5 minutes of class – be prepared!).
Tools: pen or pencil, scientific calculator.

Group Experiments

Three experiments; groups of 3-4.
Due Dates: Mon 26 Jan, Fri 13 Mar, Fri 17 Apr.
Group report: one page, single-spaced; answer assigned questions.
Names at top – signed by each member – attesting to work done.

Challenge Problems

Due Dates: each Friday (16 Jan – 17 Apr).

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

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