

PS 160 – Physics II for Engineers
Embry-Riddle University
Spring 2019

Instructor: M. Anthony Reynolds
email: reynodb2@erau.edu
web: <http://pages.erau.edu/~reynodb2/ps160> (or Canvas)
phone: (386) 226-7752
office: COAS 319.27
office hours: MWF 2:00-2:50, TTh 11:15-12:30

Required text: *Physics for Engineers 2*
(University Physics, 14th ed., by Young & Freedman)
Ch 12, 14-20, 33-36

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/arealsn.html>
Understanding Physics, by Asimov – QC 23 .A8
Cartoon Guide to Physics, by Gonick & Huffman – QC 24.5 .G66

<u><i>Percentage system:</i></u>			<u><i>Grading scale:</i></u>
1 final exam	25%	A	90% –
3 tests	60% (20% each)	B	75% – 89%
quizzes	15%	C	60% – 74%
		D	50% – 59%

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!*).

* This syllabus incorporates all existing University policies, especially those sections of the *Student Handbook* pertaining to academic integrity, civility, and respect. *

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, Waves, Sound, Fluid Mechanics
 - a. Hooke's law, simple harmonic motion – mass on a spring, pendulum
 - b. Damped, driven oscillations, resonance
 - 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
 - e. Superposition, standing waves in strings, organ pipes, beats, Fourier series
 - f. Pressure, Pascal's law, Archimedes' principle, buoyant force
 - g. Laminar flow, continuity equation, Bernoulli's equation, drag
 - h. Toricelli's theorem, Venturi tube, Pitot tube
2. 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
3. Geometric optics, Physical optics, Interference
 - 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
 - d. Young's double-slit, thin films,
 - e. Fraunhofer diffraction, Rayleigh's criterion
 - f. Single-slits, diffraction gratings
 - g. Bragg diffraction, Laue 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: 2 sharp pencils, scientific calculator, 3x5 card (both sides) for equations.

Date: Tue 30 Apr, 8:00 am – 10:00 am.

Tests

75 minutes; closed book; closed notes.

Tools: 2 sharp pencils, scientific calculator.

Dates: Thu 7 Feb, Thu 21 Mar, Tue 23 Apr.

Final exam score will replace lowest test core.

Quizzes

9 in-class quizzes, based on worked examples in each chapter.

6 take-home quizzes, based on end-of-chapter problems.

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.

Homework Log

I will post online a “homework log” to help you organize your problem-solving achievements. Follow the instructions – solve each worked example as many times as you need in order to be able to work it *without any assistance*. Solve as many exercises and problems at the end of each chapter as you need to master that topic.

Study Groups

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

Spring 2019

PS 160 - Schedule

day	date	Reading	topics
Th	10-Jan	12.1-3	fluid statics, density, pressure, buoyancy
Tu	15-Jan	12.4-6	fluid dynamics, Bernoulli
Th	17-Jan	14.1-4	oscillations, SHM
Tu	22-Jan	14.5-8	pendulum, damping, forcing
Th	24-Jan	15.1-4	mechanical waves, transverse
Tu	29-Jan	15.5-8	interference, standing waves, resonance
Th	31-Jan	16.1-4	sound waves
Tu	5-Feb	16.5-8	beats, Doppler-Fizeau effect
Th	7-Feb		Test #1
Tu	12-Feb	17.1-3	temperature, thermometers
Th	14-Feb	17.4-7	thermal expansion, calorimetry
Tu	19-Feb	18.1-3	equations of state, kinetic theory
Th	21-Feb	18.4-6	heat capacity, phase diagrams
Tu	26-Feb	19.1-4	first law of thermodynamics, internal energy
Th	28-Feb	19.5-8	work, heat, ideal gases, adiabats
Tu	5-Mar	20.1-4	heat engines, reversibility, refrigerators
Th	7-Mar	20.5-8	second law of thermodynamics, entropy
			SPRING BREAK
Tu	19-Mar		review
Th	21-Mar		Test #2
Tu	26-Mar	33.1-4	reflection, refraction
Th	28-Mar	33.5-7	TIR, dispersion, polarization
Tu	2-Apr	34.1-4	mirrors, lenses
Th	4-Apr	34.5-8	cameras, eyes, telescopes
Tu	9-Apr	35.1-3	interference, double slit
Th	11-Apr	35.4-5	intensity, thin films
Tu	16-Apr	36.1-4	diffraction, single slit
Th	18-Apr	36.5-8	gratings, x-rays, neutrons
Tu	23-Apr		Test #3
Th	25-Apr		REVIEW
Tu	30-Apr		FINAL EXAM

PS 160
 SPRING 2019

SUN	MON	TUE	WED	THU	FRI	SAT
JAN	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	FEB	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	MAR	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	APR	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	MAY	2	3	4

holidays

tests

quizzes