

PS 227 – Physics II
Embry-Riddle University
Fall 2019

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Required text: *Physics for Engineering II*
(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: This is a calculus-based introductory study of the principles of fluid dynamics, temperature, heat, laws of thermodynamics, simple harmonic motion, waves, acoustics and optics. **Prerequisites:** PS 226 or PS 150; PS 226L; 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: Wed 11 Dec, 10:15 am – 12:15 pm.

Tests

120 minutes; closed book; closed notes.

Tools: 2 sharp pencils, scientific calculator.

Dates: Wed 25 Sep (Ch 12, 14-16), Wed 30 Oct (Ch 17-20), Wed 4 Dec (Ch 33-36).

Final exam score will replace lowest test core.

Quizzes

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

12 take-home reading quizzes, based on each chapter.

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)

Fall 2019 PS 227 - Schedule

day	date	Reading	topics	RQ	Q
Tue	27-Aug	12.1-3	fluid statics, density, pressure, buoyancy	12	
Thu	29-Aug	12.4-6	fluid dynamics, Bernoulli		
Tue	3-Sep	14.1-4	oscillations, SHM	14	12
Thu	5-Sep	14.5-8	pendulum, damping, forcing		
Tue	10-Sep	15.1-4	mechanical waves, transverse	15	14
Thu	12-Sep	15.5-8	interference, standing waves, resonance		
Tue	17-Sep	16.1-4	sound waves	16	15
Thu	19-Sep	16.5-8	beats, Doppler-Fizeau effect		
Tue	24-Sep		review		16
Wed	25-Sep		Test #1		
Thu	26-Sep	17.1-3	temperature, thermometers	17	
Tue	1-Oct	17.4-7	thermal expansion, calorimetry		
Thu	3-Oct	18.1-3	equations of state, kinetic theory	18	17
Thu	10-Oct	18.4-6	heat capacity, phase diagrams		
Tue	15-Oct	19.1-4	first law of thermodynamics, internal energy	19	18
Tue	22-Oct	19.5-8	work, heat, ideal gases, adiabats		
Thu	24-Oct	20.1-4	heat engines, reversibility, refrigerators	20	19
Tue	29-Oct	20.5-8	second law of thermodynamics, entropy		
Wed	30-Oct		Test #2		
Thu	31-Oct	33.1-4	reflection, refraction	33	
Tue	5-Nov	33.5-7	TIR, dispersion, polarization		
Thu	7-Nov	34.1-4	mirrors, lenses	34	33
Tue	12-Nov	34.5-8	cameras, eyes, telescopes		
Thu	14-Nov	35.1-3	interference, double slit	35	34
Tue	19-Nov	35.4-5	intensity, thin films		
Thu	21-Nov	36.1-4	diffraction, single slit	36	35
Tue	26-Nov	36.5-8	gratings, x-rays, neutrons		
			THANKSGIVING BREAK		
Tue	3-Dec		review		
Wed	4-Dec		Test #3		
Thu	5-Dec		REVIEW		
Wed	11-Dec		FINAL EXAM		

RQ = take-home reading quiz for each chapter - due at beginning of class

Q = in-class quiz on Examples from each chapter - at beginning of class

FALL 2019

PS 227

SUN	MON	TUE	WED	THU	FRI	SAT
25	26	27	28	29	30	31
SEP	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	OCT	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	NOV	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
DEC	2	3	4	5	6	7
8	9	10	11	12	13	14

PS 227-01 - TuTh
W

09:45-11:00
17:00-19:00

COAS 125
COAS 207

FINAL:

Wed 11 Dec
10:15-12:15

review test holidays