PS 150 – Physics I for Engineers
Embry-Riddle Aeronautical University
Fall 2018

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Required text:	*Sears & Zemansky's University Physics*, 14th ed, by Young and Freedman *Volume I*, ERAU edition, Chapters 1-11, 13
Recommended:	*Physics*, by Tipler – QC 21.3 .T57
	Lectures on Physics, by Feynman – QC 23 .F47
	Understanding Physics, by Asimov – QC 23 .A85
	Cartoon Guide to Physics, by Gonick & Huffman – QC 24.5 .G66
"*Hyperphysics*"	http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
"*Simple Nature*"	http://lightandmatter.com/area1sn.html

Percentage system:		*Grading scale*:	
1 final exam	25 %	A	90 % –
3 midterm tests	60 % (20 % each)	B	80 % – 89 %
quizzes	10 %	C	70 % – 79 %
SI	5 %	D	60 % – 69 %
		F	– 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!*).

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

Course Description: Vector and scalar quantities. Kinematics, Newton's laws of motion, work and energy, conservation of energy, conservation of momentum and the center of mass and its motion. Rotational motion, conservation of angular momentum. Newton's law of gravitation, planetary orbits, Kepler's laws. **Co requisite:** MA241.

Goals: This course is the first of a three-semester course sequence for students in engineering programs. It is a survey course in mechanics, designed to provide the student with an appropriate background for more advanced physics and engineering course work.

Prerequisite Knowledge:

1. Basic algebraic manipulations.
2. Algebra of Polynomials.
3. Exponential and logarithmic functions and related manipulation. Scientific notation.
4. Trigonometric functions and identities and applications.
5. Limits and the limit process.
6. Graphical analysis of functions.
7. Vector algebra.

Learning Outcomes:

1. Solve problems involving vectors in polar coordinates and rectangular coordinates using vector addition, subtraction, multiplication (dot and cross products), and including finding magnitudes of vectors and angles between vectors.
2. Know the basic and fundamental units in the S.I. system and the English system. Be able to use dimensional analysis and be able to convert units. Be able to perform order of magnitude calculations.
3. Restate Newton's laws of motion. Solve vector problems using Newton's laws. In doing this, employ the knowledge of friction (static and kinetic) and uniform circular motion. Derive the expression for centripetal acceleration for uniform circular motion. Draw free-body diagrams.
4. Define work, kinetic energy and potential energy. Compute work for constant and variables forces. Demonstrate the use of the work-energy theorem and the conservation of energy. Define the concepts of linear momentum, impulse, center-of-mass (conservation of momentum), and demonstrate understanding by solving problems in one and two dimensions.
5. Be able to solve problems using Newton's law of gravitation and to understand orbital motion.
6. Work problems in rotational kinematics and rotational dynamics. Be able to use energy methods in rotational motion.
7. Solve rigid body equilibrium problems.

RULES

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

Final Exam

Comprehensive (Ch 1-11,13); two hours; closed book; closed notes.
Tools: 2 sharp pencils, eraser, scientific calculator, 3x5 card (both sides) for equations.
Date: Tuesday, 11 Dec
Time: 10:15 am – 12:15 pm. (Room TBA)
(You must arrive by 11:15 am; if you leave prior to 11:15 am then you may not resume.)

Midterm Tests

90 minutes; closed book; closed notes.
Tools: 2 sharp pencils, eraser, scientific calculator.
Dates: Mon 24 Sep (Ch 1-3), Wed 24 Oct (Ch 4-7), Wed 28 Nov (Ch 8-11)
Time: 6:00 pm – 7:30 pm (Room TBA)
(You must arrive by 6:45 pm; if you leave prior to 6:45 pm then you may not resume.)
Final exam will replace lowest test score.

Quizzes

Take-home quizzes, in-class quizzes.

SI (Supplementary Instruction)

Mandatory attendance once per week. Time and location TBA.

Highly recommended

Worked examples and exercises in textbook (see Homework Log).

Allowed calculators: non-programmable, non-graphing, scientific calculator

Bring Eagle card to all tests and exams.

Use the restroom ***before*** all tests and exams.

There are no make-up tests or exams.

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* the basic principles used to solve the problem and *justify* the basic equation(s) that are used in the solution [DO NOT 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.

Study Groups

Do not simply copy another student's work, 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.

"For most individuals, learning is most effectively carried out via social interactions."

- Ed Redish

Rules for writing mathematics

- write neatly
- use a sharp pencil (not a pen)
- organize your writing in a coherent and logical fashion
  - random equations splattered over the page are not acceptable
  - order your work from top to bottom and left to right
- write full equations, not just quantities
- do not erase large sections (lightly cross out) — erase only small mistakes
- use proper symbols, i.e., use ρ not D for density — case matters: a is not A
- subscripts are important, i.e., $a_x \neq ax$
- your *scientific* calculator must use proper scientific notation
  - keep all digits during computation, but truncate to 3 at the end
- separate factors with parentheses, not dots, i.e., use (5 m)(10 N) not 5 m $\cdot$ 10 N, and do not use crosses, i.e., not 5 m $\times$ 10 N.
  - also place parentheses correctly, i.e., $\left(15\frac{\text{m}}{\text{s}}\right)^2$ not $\left(15\frac{\text{m}^2}{\text{s}}\right)$
- use horizontal lines for fractions, $\frac{5}{3}$ not 5/3
- solve for quantities without dividing, i.e., starting with $63x = 52$, do not write $\frac{63\,x}{63} = \frac{52}{63}$, but immediately write $x = \frac{52}{63}$.

Rubric for solving physics problems

- start with a brief **justification** (in words) of the physics and write the main formula (4 points)
  - Do not simply say, "Calculate t and v."
- solve for the desired quantity **algebraically** (3 points)
- plug in correct values **with units** (2 points)
- solve for (and box) final numerical answer (1 point) — note: $g = 9.81\ \frac{\text{m}}{\text{s}^2}$
  (on a test, transfer this final answer to the supplied box)

PS 150	Sears/Zemansky 14e		Fall 2018	
	sections to read			
date	start	end	topic	quiz
27-Aug	intro	5.5	physics overview	
29-Aug	1.1	1.5	units, how to solve problems	
31-Aug	1.6	1.10	vectors	1
5-Sep	2.1	2.3	position, velocity, acceleration	
7-Sep	2.4		constant acceleration	2
10-Sep	2.5	2.6	free fall, integration	
12-Sep			1D problems	
14-Sep	3.1	3.2	velocity, acceleration vectors	3
17-Sep	3.3		projectile motion	
19-Sep	3.4	3.5	circular/relative motion	
21-Sep			2D/3D problems	4
24-Sep	review		test #1 (Ch 1-3)	
26-Sep	4.1	4.3	Newton's Laws 1	
28-Sep	4.4	4.6	Newton's Laws 2, force diagrams	5
1-Oct	5.1	5.2	N1 and N2	
3-Oct	5.3		friction	
5-Oct	5.4		circular dynamics	6
8-Oct	6.1	6.2	work/kinetic energy	
10-Oct	6.3		work-energy theorem	
12-Oct	6.4		power	7
15-Oct	7.1	7.2	potential energy	
17-Oct	7.3	7.4	conservative forces	
22-Oct	7.5		energy diagrams	8
24-Oct	review		test #2 (Ch 4-7)	
26-Oct	8.1	8.2	impulse/momentum conservation	
29-Oct	8.3	8.4	elastic/inelastic collisions	
31-Oct	8.5	8.6	center of mass	
2-Nov	9.1	9.2	angular kinematics	9
5-Nov	9.3	9.4	energy	
7-Nov	9.5	9.6	parallel axis thm/moment of inertia	
9-Nov	10.1	10.2	rotational dynamics/torque	10
14-Nov	10.3	10.4	work/power/angular momentum	
16-Nov	10.5	10.7	L conservation/equilibrium	
19-Nov	11.1	11.3	equilibrium/center of mass/gravity	
26-Nov	11.4	11.5	stress/strain	11
28-Nov	review		test #3 (Ch 8-11)	
30-Nov	13.1	13.4	gravitational force/potential energy	
3-Dec	13.5	13.8	Kepler's laws/rotation/black holes	
5-Dec			dark matter	
11-Dec	final exam		10:15-12:15	0

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SUN	MON	TUE	WED	THU	FRI	SAT
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	15

holidays tests quizzes