

PS 150 – Physics I for Engineers  
Embry-Riddle University  
Fall 2008

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*Instructor:* M. Anthony Reynolds  
*email:* reynodb2@erau.edu  
*web:* <http://faculty.erau.edu/reynolds/ps150> (or Blackboard)  
*phone:* (386) 226-7752  
*office:* Lehman 313  
*office hours:* MWF 10:30-11:30 and 1:00-2:00  
TTh 11:00-12:00

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*Required text:* *Principles of Physics*, 4th edition, by Serway & Jewett  
Chapters 1-8, 10, 11  
*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

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<u><i>Point system:</i></u>		<u><i>Grading scale:</i></u>		
1 final exam	200 points	200	A	900 –
3 tests	200 points each	600	B	750 – 899
120 problems	1 point each	120	C	600 – 749
10-15 quizzes	1-4 points each	60	D	500 – 599
3 group experiments	10 points each	30		
3 reports	10 points each	30		
13 challenge problems	4 points each	52		

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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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**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 variable 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. Work problems in rotational kinematics and rotational dynamics. Be able to use energy methods in rotational motion.

**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, 9 December, 10:15 am – 12:15 am.

**Tests**

One-hour; closed book; closed notes.  
Tools: pen or pencil, scientific calculator.  
Dates: Wed 24 Sep, Fri 24 Oct, Mon 24 Nov.  
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**

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: Wed 10 Sep, Fri 10 Oct, Mon 10 Nov.  
Group report: one page, single-spaced; answer assigned questions.  
Names at top – signed by each member – attesting to work done.

**Reports**

Three reports on assigned articles.  
Due Dates: Wed 17 Sep, Fri 17 Oct, Mon 17 Nov.  
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 (29 Aug – 5 Dec).

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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.

Important things to cover

Overview of all of physics

What we'll cover in this course

First day – powers of ten web site, universe, fundamental particles

No calculators?

Simple Nature textbook?

Newton's 2nd law – definition vs law

$a = dv/dt$  is a definition, but  $F=ma$  is a law, it does not define  $F$

see Physics Teacher Sep 1991, p350, article by Douglas Kurtze

similar to  $\sin\theta = o/h$  is a definition, but  $\sin^2 + \cos^2 = 1$  is a “law”