PS 150 – Physics I for Engineers
Embry-Riddle University
Fall 2003

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office hours: 15:00 – 16:30, Mon, Tue, Wed, Fri (and by appointment)

Required text: *University Physics*, 11th edition, by Young & Freedman
Recommended: any calculus-based physics textbook, choose one you like
Recommended in the library: *Understanding Physics*, by Asimov
Cartoon Guide to Physics, by Gonick & Huffman
3000 Physics Problems

Grading:	20%	weekly homework
	60%	three one-hour exams (20% each)
	20%	two-hour final exam
	5%	attendance/participation

Homework: Assigned weekly, and due at the beginning of class. Graded for correctness. Late homework will not be accepted. The lowest homework score will be dropped.
Exams: Three one-hour exams. No make-ups. The score on the final exam will replace the lowest score.
Final exam: Sat 6 Dec, 19:15 – 21:15. Two-hours. Comprehensive.

Holidays: Fri, 7 Nov (University Day)
Wed – Fri, 26-28 Nov (Thanksgiving)

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: Vector and scalar quantities. Geometrical optics, kinematics, Newton's laws of motion, work and energy, conservation of energy, conservation of momentum and the center of mass and its motion. **Co requisite:** MA241.

Goals: This course is the first of a three-semester course sequence for students in the Aerospace Engineering, Electrical Engineering, Aviation Computer Science and Engineering Technology programs. It is a survey course in mechanics and special relativity, 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 difference between geometrical optics and physical optics. Be able to use and understand the usefulness of the ray method and draw ray diagrams using the three basic rays. Define the index of refraction and realize that it depends on wavelength. Be familiar with $v = f\lambda$. Know why waves refract and be able to apply Snell's law to solve problems.
3. Be able to calculate image, object distances and focal lengths for concave and convex mirrors and thin lenses. Be able to use the lensmakers equation in solving problems. Be able to analyze and solve systems with more than one lens, using ray diagrams and equations. Know how to apply this to instruments like the camera and telescope. Know that light intensity drops off as $1/r^2$ and the units for light intensity.
4. 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.
5. 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.
6. 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.

Code of Behavior

In order for learning to take place, we all must act with civility (formal politeness) and respect (polite consideration, courtesy) toward each other. My responsibilities include coming to class prepared and on time, and evaluating you in a fair and impartial manner. Your responsibilities include coming to class prepared and on time, not disrupting the class (for example, talking without being called on, eating, reading newspapers, shuffling papers, talking on cell phones, etc.), and treating your fellow students as colleagues (see the Student Handbook). Violations of this code can result in your removal from the class.

Academic Integrity

Issues of academic integrity are discussed on page 23 of the Student Handbook. They include plagiarism, cheating and fraud. Please read this section, and if you do not understand it, come see me. Some important passages are reproduced here:

"Sanctions [for academic dishonesty] may include failure of a test or assignment, failure of a course, suspension, or dismissal from the University."

"Plagiarism is recognized by the University as an act of academic dishonesty. It is defined as taking the ideas, writings, work, and/or words of another and representing them as one's own. Two common forms of plagiarism involve the use of written or oral work of another person without giving proper acknowledgment and the use of the oral work of another person as one's own."

> "Consider the example of a highly intelligent 7-year-old whom I wish to teach to play chess, although the child has no particular desire to learn but only a very strong desire for candy and little chance of obtaining it. I therefore tell the child that if the child will play chess with me once a week I will give the child 50 cents worth of candy ... and an extra 50 cents worth if the child wins ... The child then has every reason to cheat, provided he or she can do so successfully. But, so we hope, there will come a time when the child will find satisfaction in trying to excel in whatever way the game of chess demands. If the child still cheats, he or she will be defeating not me, but himself or herself."
>
> - Alasdair MacIntyre, *After Virtue*

Office hours

I am always in my office during my office hours, and this is your time to speak with my about any aspect of the course. Also, I am generally in my office between 9 am and 5 pm, and available at times other than my office hours. However, I may be teaching or doing research, and not available immediately. If you need to speak with me, drop by or call me and set up an appointment.

Tutoring Center

There is free physics and chemistry tutoring in LB 374. Check the door for the latest schedule. Please avail yourself of this resource.

Attendance

Class attendance is mandatory, and an attendance sheet will be passed around each class. Even though I will readily allow you to miss a class for a legitimate reason, you are still responsible for the material in lectures whether you are present or not.

Reading and Notes

The textbook is your primary source of information – not lecture. If you don't like the assigned text, find one that you do like (they are all essentially equivalent) – check one out of the library or buy one from a used bookstore. Reading the text is mandatory and is to be done *before* each class. It is extremely important that you come to class prepared to think and discuss the day's topic. Not knowing that topic is a serious detriment to learning. The schedule is listed at the end of this syllabus. *How* to read the textbook is suggested below.

Taking notes during lecture is also important – but you must review those notes after class (within a few hours). Notes that are never reviewed are less than worthless: they give you a false sense of security.

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, review. The textbook should be read THREE times: skim lightly once before class, read deeply (at least) once after class, 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)

Homework

Ten problems are assigned weekly, and are due at the beginning of the class period on the due date. Each problem will be graded on a scale of 0 to 5 – 5 points for correct, 2-4 points for correct ideas but missing pieces, 1 point for a weak attempt, 0 points for not seriously attempting. These problem sets are **critical** to your success in this course. Not only are they worth 20% of your grade, but also because the exam problems will be very similar to the homework problems, doing the homework well will boost your exam performance. I will post detailed solutions of the assigned problems on the course web site. I suggest that you solve other problems as well, as practice for the exam, and my suggestions as to which extra problems to solve are listed with the assigned problems.

Two extra credit points are available for each homework problem (not the questions) if you solve the problem 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. This is the most important component of coherence and no extra credit points will be give for any problem solution that does not contain such a description.
- 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.
- Show explicitly that your symbolic answer has the correct units.
- If possible, check your symbolic answer by looking at limits in which the answer is obvious.
- 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.

Read the "Problem Solving Strategies" in the textbook. They are extremely helpful and suggest explicit techniques for attacking problems. Do not simply copy another student's work (see the statement about plagiarism above), but I recommend that you form study groups and work together. This can help you through difficult sections and problems.

Exams

Three one-hour in-class exams, and one two-hour final exam will be given. All exams are closed book and closed notes. One 3"x5" card with your notes (on both sides) is allowed on the final (but not on the one-hour exams). Programmable calculators are NOT allowed (e.g., TI-80 and above). These rules will be strictly enforced.

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 without any help. If you can do this with several problems from each chapter, you should do fine on the exams. To help you, I have added ten extra problems from each chapter that can be used for this purpose. They are NOT to be turned in.

Grading System

From page 26 of the Student Handbook: "The following grades are used by the faculty to indicate the quality of work performed." (*I have added my own interpretations in italics – including the percentage score to attain this level.*)

A = Superior (*Performance of the student has been of the highest level, showing sustained excellence in meeting course responsibilities – 90%*)
B = Above Average (*Performance of the student has been good, though not of the highest level – 75%*)
C = Average (*Performance of the student has been adequate, satisfactorily meeting the course requirements – 60%*)
D = Below Average (*Performance of the student has been less than adequate – 50%*)
F = Failure (*Performance of the student has been such that course requirements have not been met.*)

Contrary to popular belief, you *are* in the "real world" now. Your success depends on you alone. You must be self-critical and determine the method by which you study best. Whatever method you use, I believe that success requires a minimum of **six** hours per week outside of lecture. Come see me if you desire suggestions on time management, study hints, or anything that will help you succeed in this course.

You also need adequate sleep and exercise. If you don't get these, your body will not be able to function well (even though your mind is willing).

Lecture schedule		
Week	**Topics**	**Chapters in Young**
1	Fundamentals (review)	1, App B
2-3	Optics (mirrors, lenses)	33, 34
4-6	Kinematics (one and two dimensions)	2, 3
7-9	Dynamics (Newton's laws & gravitation)	4, 5
10-11	Energy (work, potential energy)	6, 7
12	Momentum (collisions)	8

Exam schedule		
Exam	**Date**	**Chapters in Young**
1	Friday, Oct 3	33, 34, 2
2	Friday, Oct 31	3, 4, 5
3	Monday, Dec 1	6, 7, 8
Final	Saturday, Dec 6	All

Homework schedule

Chapter 1
Due Wed Sep 10: Q3, Q8, Q10, 6, 12, 29, 57, 60, 64, 97
Exam practice: Q15, Q17, Q20, 33, 41, 48, 52, 73, 80, 88 (these use vectors, needed for Ch 3)

Chapter 33
Due Wed Sep 17: Q1, Q2, Q6, 6, 9, 19, 41, 54, 56, 62
Exam practice: Q4, Q8, Q22, 14, 18, 31, 46, 49, 52, 55

Chapter 34
Due Wed Sep 24: Q3, Q11, Q15, 2, 9, 14, 26, 66, 94, 116
Exam practice: Q4, Q5, Q21, 5, 7, 24, 31, 40, 93, 114

Chapter 2
Due Wed Oct 1: Q1, Q11, Q19, 6, 10, 22, 38, 41, 58, 90
Exam practice: Q4, Q14, Q20, 5, 11, 17, 23, 74, 82, 91

Chapter 3
Due Wed Oct 15: Q1, Q9, Q13, 3, 12, 21, 29, 59, 79, 92
Exam practice: Q5, Q10, Q14, 7, 11, 16, 32, 37, 71, 89

Chapter 4
Due Wed Oct 22: Q8, Q26, Q34, 2, 14, 17, 23, 24, 46, 49
Exam practice: Q13, Q20, Q35, 4, 9, 16, 21, 30, 39, 52

Chapter 5
Due Wed Oct 29: Q7, Q10, Q28, 7, 19, 21, 46, 61, 114, 125
Exam practice: Q14, Q16, Q26, 13, 15, 28, 49, 86, 111, 121

Chapter 6
Due Wed Nov 12: Q1, Q10, Q16, 7, 13, 34, 46, 81, 93, 101
Exam practice: Q3, Q12, Q17, 4, 27, 42, 54, 68, 84, 102

Chapter 7
Due Wed Nov 19: Q1, Q5, Q16, 12, 23 (Ex 7.11), 31, 37, 41, 53, 87
Exam practice: Q6, Q10, Q12, 5, 19, 32, 33, 46, 68, 79

Chapter 8
Due Wed Nov 26 (5pm): Q2, Q13, Q19, 10, 17, 28, 40, 63, 73, 101
Exam practice: Q3, Q9, Q22, 22, 34, 43, 45, 71, 89, 94