PS 250 – Physics III for Engineers
Embry-Riddle University
Summer A 2014

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Required text:	*University Physics*, 13th ed, by Young & Freedman Chapters 21-30, 32, 37, 39
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/area1sn.html
	Understanding Physics, by Asimov – QC 23 .A8
	Cartoon Guide to Physics, by Gonick & Huffman – QC 24.5 .G66

Percentage system:		*Grading scale*:	
1 final exam	30%	A	90% –
2 tests	50% (25% each)	B	75% – 89%
Problem Sets	12%	C	60% – 74%
Quizzes	8%	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!*).

Course Description: Electric forces, electric field and Gauss's Law; Electric potential and electrostatic potential energy; Capacitance; Simple DC circuit theory; Magnetic force, magnetic field and Ampere's Law; Faraday's Law; Inductance; Electromagnetic oscillations and wave propagation; Relativity, selected topics in modern physics. **Prerequisites**: PS 160 and MA 242.

Topics to be covered

0. Review of Gravity
    a. Inverse square force law, gravitational field and potential
    b. Fundamental forces
1. Electrostatics and Magnetostatics
    a. Maxwell's equations
    b. Coulomb's law, hydrogen atom, superposition and linearity
    c. Electric field of a point charge, line charge, dipole, charged sheet
    d. Motion in uniform **E** field
    e. Electric potential: equipotentials, superposition, electric field as gradient
    f. Magnetic field: Biot-Savart law
    g. Motion in a uniform **B** field
    h. Magnetic dipole: forces and torques
2. Gauss's Law, Capacitors, Circuits, Ohm's Law, Ampere's Law
    a. Gauss's law, field lines, flux
    b. Capacitance, dielectrics, simple circuits
    c. Resistance, conductance, Ohm's law, Kirchoff's laws (voltage and current)
    d. RC circuits
    e. Ampere's law
3. Faraday's law, Electromagnetic waves, Relativity
    a. Inductance, emf, Lenz's law, Faraday's law
    b. Maxwell's equations, displacement current
    c. EM waves, polarization
    d. Einstein's principles
    e. Length contraction, time dilation
    f. Mass and energy
4. Quantum, nuclear, and particle physics
    a. Topics selected from …
        i. Blackbody radiation
        ii. Photoelectric effect
        iii. Quantum tunneling
        iv. Bohr's atomic model
        v. Radioactivity
        vi. Quarks, leptons, antimatter

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: Saturday 21 June, 1:00 pm – 3:00 pm.

Tests

One-hour; closed book; closed notes.
Tools: pen or pencil, scientific calculator.
Dates: Thu 22 May, Thu 5 June. (5:00pm)
No makeup tests.

Problems

13 problem sets; 8-10 problems each; must be neat and stapled.
Due Dates: approximately every other class period.
Graded on completeness and effort.

Quizzes

Take-home *and* in-class (first 5 minutes of class – be prepared!).
Tools: pen or pencil, scientific calculator.

Challenge Problems

Extra credit. Must be submitted by 12 June.

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.

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, sleeping, 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.

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, 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

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

Preliminary schedule

Part 0. Gravitational review relevant to electrostatics

READING:
Young & Freedman, Sections 13.1, 13.3, 13.6
A Field Theory Primer, Section 1, "Preliminaries"

Problem Set #1	due Mon 5/12	Ch 13 – 5, 17, 31, 32, 33

Part 1. Electrostatics and Magnetostatics

READING:
Electric field: 21.1-5, 7 (and skim 25.1-3)
Electric potential: 23.1-5
A Field Theory Primer, Sections 2-3, "Basic and Intermediate Field Theory"
Magnetic field I: 27.1-2, 28.1-5
Magnetic field II: 27. 4-7,9

Problem Set #2	due Wed 5/14	Ch 21 – 1, 3, 7, 15, 25, 30, 37, 43, 54, 57
Problem Set #3	due Thu 5/15	Ch 23 – 1, 3, 13, 21, 27, 29, 45, (EC 59)
Problem Set #4	due Tue 5/20	Ch 27 – 5, 9; Ch 28 – 3, 5, 14, 15, 17, 27, 30, 32, (EC 2)
Problem Set #5	due Thu 5/22	Ch 28 – 37, 39; Ch 27 – 15, 21, 30, 32, 36, 42, 45, 53

Exam #1 – Thu 5/22 5:00pm

Part 2. Gauss's Law, Capacitors, Circuits, Ohm's Law and Ampere's Law

Part 3. Faraday's Law, Electromagnetic Waves, Relativity

Part 4. Selected Topics from Quantum Physics