PHYS 122.01, Engineering Physics II
Syllabus—Spring 2012

Catalog Description

PHYS 122 Engineering Physics II (3-0-3), spring. Heat, thermodynamics, electricity, and magnetism. Concurrent enrollment in PHYS 123. Prerequisites: PHYS 120/121.

ACU Mission Statement

ACU's mission is to educate students for Christian service and leadership throughout the world.

Departmental Vision Statement

The vision of the ACU Engineering & Physics Department is to be the premiere engineering and physics department for the preparation of students for Christian service and leadership throughout the world.

Instructor

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Text

The following texts are **required:**
Six Ideas That Shaped Physics: Unit R (2nd ed) by Thomas Moore
Six Ideas That Shaped Physics: Unit E (**Draft 3rd ed**) by Thomas Moore
Six Ideas That Shaped Physics: Unit T (2nd ed) by Thomas Moore

Other Materials

A green or purple ink ***pen***, lots of paper clips, and a straight edge and possibly protractor.

Course Description

Engineering Physics II is a continuation of Engineering Physics I (its prerequisite), and as such is an introductory calculus based physics course directed principally towards physics, engineering, mathematics, and chemistry majors. In this course we focus on special relativity, electromagnetism, and an introduction to statistical mechanics, as well as modern applications of all of these topics.

Web Site

The syllabus, course schedule, and instructor contact information will be placed on the Blackboard site for this course. You will also find it extremely useful to consult the web site for the textbook, at:

`http://www.physics.pomona.edu/sixideas/`

In particular, this web site contains computer programs that you will need both for viewing homework solutions, and for completing some problems. There are versions available for Windows, Mac, and Linux.

There is one password used to access all problems this semester, as they become available; it is **IwantACUep2ans**.

An Analogy

Research into how we best learn physics—and perhaps your own experience as well—show that it has very little to do with memorizing a set of facts. Rather, it is more like learning a sport or a musical instrument: merely watching someone else (me!) do it will have very little impact on acquiring new skills.

This course is structured with that in mind. Daily readings and homework, as well as our class sessions, are like "practice," and I and your lab TA's and tutors are more like coaches. This means you can't learn physics by cramming right before an exam any more than you could skip practice all season and expect to do well at a big meet by training really hard for two days. The course policies set out in this syllabus are designed to reinforce this approach to learning.

Course Goals

1. To have a comfortable and detailed knowledge of basic physical principles from relativity, electromagnetism, and statistical mechanics.
2. To model real-world problems and apply basic principles to solve those problems using a "top down" approach.
3. To understand how the topics we cover fit into the larger scheme of physics, and something about the scientific inquiry which has led to their adoption.

Roughly speaking, conceptual knowledge in any of the goals above is assessed through quizzes, the basic homework problems (labeled with a "B" in the text), and the final. Your application of modeling and problem solving skills (the second goal above) will be measured through "S" and "R" homework problems and the unit exams. Detailed information on grading is given below.

Competencies and Assessment

The following table lists **some** of the key competencies you are expected to acquire to successfully complete this course, and how they will be assessed.

Competency	**Measurement**	**Criteria**
Construct and reason from two-observer space-time diagrams	Homework, Quizzes, Unit R Exam	Be able to draw and calibrate diagrams, and use to resolve apparent paradoxes
Apply conservation of four-momentum	Homework, Quizzes, Unit R Exam	Solve scattering problems using conservation; deduce four-momentum from energy-momentum diagrams.
Distinguish and use electric and magnetic forces from electric and magnetic fields	Homework, Quizzes, Unit E1-E9 Exam	Calculate force from field and vice-versa; determine nature of fields present from motion of charges
Determine fields from charge distributions	Homework, Quizzes, Unit E Exams	Use symmetry to determine direction of fields; superposition to determine magnitude; reach same conclusions using Gauss's and Ampere's laws
Justify thermodynamic laws from statistical mechanical principles	Homework, Quizzes, Unit T exam	Calculate entropy directly for Einstein solids; use fundamental postulate of stat mech to derive and apply Boltzmann's law

Course Meetings

Our class time together will ***always*** assume that you have read the assigned readings; all of these are in the schedule attached to this syllabus (the chapters are in bold in the upper right corner of each day). In class, we will devote much of our time to active learning activities that help you practice what you have read about.

Homework

With only very few exceptions (indicated on the schedule) **you have homework due every day!** On days when you have been assigned to read a new chapter before coming to class, you will have two homework problems due from that assigned chapter. This is to help you practice the concepts you are reading about. On days where we recap what we have learned, you will have four harder problems due from the preceding chapters. These problems will be from what we recapped *before* that day, and therefore what was covered in class the first time two weeks prior.

All homework is due at the beginning of class time; if you come in late your work will not be accepted.

Each **problem** that you turn in should be on its ***own sheet*** (or sheets) of paper; all problems for a set **must** be paper-clipped together. Work should be neat, edges of spiral paper trimmed, and your work should be turned in on blank paper (not the back of something else, a napkin from the Bean, etc.). Each problem should have your name on it. **Work failing to meet any of these conditions will not be graded.**

Each problem you turn in will be graded according to the following ten-point scale:

Complete (3 points) Points awarded as:

3 = All parts present and fully developed
2 = Some parts incomplete
1 = Major sections missing
0 = Little meaningful work done

Clear (2 points) Points awarded as:

2 = Model (physical reasoning) clear to grader
1 = Some parts of model unclear
0 = Model completely unclear

Plausible (1 point) One point awarded if the result's magnitude, sign, and/or units are plausible, ***or if you recognize that your result is not reasonable, and explain (correctly) how you know.***

Initially OK (1 point) If the solution is initially OK (full credit in all other sections) the first time the problem is turned in, then you get this extra point.

Correct (3 points) Points awarded as:

3 = no modeling *or* algebraic errors
2 = some modest errors
1 = fundamental errors
0 = almost nothing correct

On Monday, you will receive back your graded homework from the week before. At your option, you may **correct any of those problems (from the week before)**, to be turned in to the box outside the Physics Office by ***5 PM on Friday***. Your corrections must be in green or purple ***ink***, on the original paper you turned in. **You may only earn additional points in the "Clear" and "Correct" categories**.

What do the above categories mean? "Complete" means you made a full attempt at all things that are necessary for a full solution: that is, there is a translation step, a model step, setting up some master equation, solving, and evaluation. "Correct" addresses how well you did each of those things. In the "Clear" category, we are interested in how clear your physical reasoning is: how have you modeled the problem, what assumptions have you made and why, what physical principles are you starting from and why; though it should be possible to follow your math (of course) this is really not about showing extra lines in your algebraic solution.

In summary, there will be very, very few problems (a few of the "basic skills" problems, at most) where you can get by with just a sequence of equations leading up to a number. Usually a solution of that form will lose points in both the "Complete" (because you have omitted important steps like translation, modeling, or evaluation) and "Clear" categories (because your* physical *reasoning is unclear).

At the very least you should have a sentence or two explaining your strategy and physical reasoning, though for many problems that will* not *be sufficient.

By Friday afternoon, solutions will be available using the "ProbViewer" program available from the **textbook** website—***see the first page for the password***. You have until 5:00 PM on the following Friday to turn in corrections for those problems if you desire. Note that verbatim copying of posted solutions will not be accepted: the point is to correct what *you* did initially. And while you may collaborate with other students in working problems initially and for corrections, each of you must turn in your own work: copying is a violation of ACU's academic integrity policy.

It is a violation of the course academic integrity policy to attempt to print, save or copy the posted solutions in any way other than to use them to correct your own work.

Your lowest ***ten (10)*** problems will be dropped when computing your average. This is designed to allow you flexibility to cope with roommate-induced insomnia, illness, family emergencies, and the like. For this reason, no late homework will be accepted for any reason, including excused absences (see below). If you know in advance you will be gone **for an excused absence** then you may turn in an assignment early, but never late.

Quizzes and Exams

There are nine quizzes and three exams, as well as a comprehensive final. The first exam—over Unit R—is given on Monday, February 20 as indicated on the schedule. The next exam covers just chapters E1 through E9 of unit E, and is given on Wednesday, March 28. The last exam covers chapters E10 through E16.1 and as much of unit T as we cover in class; it will be given during the first hour of the final exam period scheduled by the university; the final itself is then given during the during the remaining forty-five minutes of that time block.

Quizzes are allotted ten minutes each and are conceptual in nature; any calculations should be quick and almost immediate. They are closed note, closed book, closed neighbor, and calculators are not allowed. They are most similar to the two minute problems we will frequently do in class. Your lowest two quiz scores are dropped in computing your quiz average.

The exams probe your ability to work longer problems. You are allowed to bring one 5.5 inch by 8 inch paper (cut a standard piece of paper in half) with anything you want written on it, but you may not use any optical magnification devices to look at it. You may bring a calculator, but it must not contain any stored formulas or other information. You may **not** use an iThing or any other device with communication capabilities.

Each problem on an exam will either be broken into steps with points listed for each step, or will have a scoring guide assigning points for each step. These guides are intended not only to let you know what various steps are worth, but to provide a skeleton structure for how to attack the problem; make sure that you take advantage of them in this way, as otherwise it may be very difficult to complete the problems in the time alloted.

The final is more conceptual, like the quizzes; you may keep the piece of paper that you have brought for the unit exam immediately before it.

Makeup quizzes and exams are given ***only*** when missed for an excused absence. Makeup quizzes and exams may be different from the exam missed, and must be taken on the first school day you return after missing an exam, even if that is not a day this class normally meets. When scheduling the makeup quiz or exam, only class conflicts will be considered: you are responsible for making alternate arrangements for work or other extra-curricular activities. You must always contact the instructor ***before*** you miss a quiz or exam, even if that is only a phone call the morning of the exam. Per university regulation, you may not take the final exam early for any reason, including excused absence.

If you miss an exam or quiz for medical reasons, you must provide a note from a licensed health-care professional stating that you were **medically unable** to take the exam; a note confirming that you kept an appointment is ***not*** sufficient. You are medically excused only if you had an urgent health situation; routine visits should be scheduled so as not to conflict with class time.

Grading Scale

Grades will be assigned based on the following scale for your overall average:

A	90-100%
B	80–89%
C	70–79%
D	60–69%
F	$< 60\%$

The weighting for the final average is:

Homework	30%
Quizzes	30%
Unit Exams	10% each
Final	10%

Attendance & Conduct

Attendance is checked primarily through daily homework; as already noted it is never accepted late, for any reason. Also as noted, quizzes and exams can only be made up when missed for an excused absence; these are times when you must miss class because of illness, death in your immediate family, or travel on an ACU sponsored activity. The absence will not be excused until you have provided the instructor documentation in writing. Following university regulation, you will be dropped from the course with a failing grade if you miss more than 20% of the class meetings.

Our class time together will consist of active learning activities (as noted), but that does not mean that you (or I) can be disruptive or disrespectful to each other. In particular, you may not sleep, do other work, or be otherwise distracted. The latter includes in particular ***any*** use of cell phones, text messaging, iThing®, laptop computers, music players, and the like; make sure all such devices are turned off before you enter the classroom. You also may not distract the class by preparing to leave early; if you have a valid reason for needing to leave before the scheduled 10:50 dismissal time you must inform the instructor and obtain his consent prior to the start of class. If you fail to heed these warnings, your assignment for that day will receive a zero that you cannot correct and that will not be part of the lowest fifteen dropped from your homework average.

Academic Integrity

As ACU students you are expected to embody honesty in all aspects of your life. Students found to be cheating on a quiz or exam (whether giving or receiving help) will receive a zero for that activity. A second such offense results in a failing grade in the course. If your cheating occurs on the homework, then you on the first offense you will receive a zero for all problems assigned that week, or the preceding eight problems if fewer than eight are assigned in that week. You will also lose **all** of your dropped homework privilege. This will also mean that any further cheating of any kind will result in your failing the course. Finally, note that verbatim copying of a posted solution for homework also counts as a violation of the academic integrity policy, and the same penalty as above for cheating on your initial attempt at a problem applies. If you are found to be using a cell phone or other communication device during a quiz or exam, you will be **presumed** to have cheated, until you prove otherwise to my sole satisfaction. Such devices may **not** be used as calculators even in situations where calculators are permitted. You are also bound by the ACU academic integrity policy, found in the student guide; the required excerpt is below:

Violations of academic integrity and other forms of cheating, as defined in ACU's Academic Integrity Policy, involve the intention to deceive or mislead or misrepresent, and therefore are a form of lying and represent actions contrary to the behavioral norms that flow from the nature of God. Violations will be addressed as described in the Policy. While the university enforces the Policy, the most powerful motive for integrity and truthfulness comes from one's desire to imitate God's nature in our lives. Every member of the faculty, staff and student body is responsible for protecting the integrity of learning, scholarship and research. The full Policy is available for review at the Provost's office web site (http://www.acu.edu/campusoffices/provost) and the following offices: provost, college deans, dean of campus life, director of student judicial affairs, director of residential life education and academic departments.

Engineering Physics II Schedule
Spring 2012
All problems are **due** on the date shown below

JAN	16 MLK Holiday	18 **R1** The Principle of Relativity	20 **R2** Synchronizing Clocks R2B.4, R2B.5
	23 **R3** The Nature of Time R3B.3, R3B.5	25 Recap R1-R3 R1S.11, R2R.2, R3S.2, R3S.7	27 **R4** The Metric Equation **Quiz R1-R3** R4B.3, R4B.6
	30 **R5** Proper Time R5B.3, R5B.7	1 **R6** Coordinate Transformations R6B.1, R6B.6	3 Recap R4-R6 R4S.4, R5S.3, R6S.5, R6S.6
FEB	6 **R7** Lorentz Contraction **Quiz R4-R6** R7B.3, R7B.6	8 **R8** The Cosmic Speed Limit R8B.1, R8B.4	10 **R9** Four-Momentum R9B.3, R9B.6
	13 **R10** The Conservation of Four-Momentum R10B.1, R10B.3	15 Recap R7-R10 R7R.1, R8S.4, R9S.11, R10S.9	17 **E1** Basic Electrostatics **Quiz R7-R10** E1B.1, E1B.6
	20 ***UNIT R EXAM***	22 **E2** Electric Fields E2B.3, E2B.7	24 **E3** Continuous Charge Distributions E3B.1, E3B.3
	27 Recap E1-E3 E1S.6, E2S.3, E2S.9, E3S.4	29 **E4** Electric Potential **Quiz E1-E3** E4B.2, E4B.11	2 **E5** Currents E5B.4, E5B.11
MAR	5 **E6** Circuits E6B.8, E6B.9	7 Recap E4-E6 E4S.3, E4S.12, E5S.8, E6S.3	9 **E7** Magnetic Fields **Quiz E4-E6** E7B.2, E7B.6
	19 **E8** Currents Respond to Magnetic Fields E8B.3, E8B.5	21 **E9** Currents Create Magnetic Fields E9B.1, E9B.6	23 Recap E7-E9 E7S.4, E8S.7, E9S.4, E9S.8
	26 **E10** Gauss's Law **Quiz E7-E9** E10B.3, E10B.4	28 ***UNIT E1-E9 EXAM***	30 **E11** Ampere's Law E11B.6, E11B.7
APR	2 **E12** Calculating Fields E12B.5, E12B.8	4 Recap E10-E12 E10S.2, E11S.3, E12S.5, E12S.8	6 Easter Holiday
	9 **E13** Maxwell's Equations **Quiz E10-E12** E13B.1, E13B.3	11 **E14** Induction E14B.4, E14B.7	13 **E15-E16.1** Waves E15B.7, E16B.1
	16 Recap E13-E16.1 E13S.5, E14S.5, E15S.8, E16S.1	18 **T1** Temperature **Quiz E13-E16.1** T1B.2, T1B.4	20 **T2** Ideal Gases T2B.2, T2B.6
	23 **T3** Gas Processes T3B.1, T3B.3	25 Recap T1-T3 T1S.3, T2S.5, T3S.5,T3R.1	27 **T4** Macrostates and Microstates **Quiz T1-T3** T4B.2, T4B.7
MAY	30 **T5** The Second Law T5B.3, T5B.7	2 **T6** Temperature and Entropy T6B.2, T6B.5	4 Recap T4-T6 T4S.5, T, T5S.3, T5S.6, T6R.1

Note that the week of Spring Break is not shown in the schedule above; it is March 12-16