CSUC, Department of Physics Fall 2012
PHYSICS 204B : ELECTRICITY and MAGNETISM
Section **4** (lab sections **5** & **6**)

Instructor: Louis Buchholtz Office: PHSC 120 Ph: 3418 / 6259 lbuchholtz@csuchico.edu
(our class web site) http://phys.csuchico.edu/buchholtz/

Office Hours: (to be determined by class consensus/ see below)

Lecture: MWF 10-10:50 AM PHSC 109

Lab: section-**5** Monday 11AM
PHSC 108
section-**6** Friday 11AM

Text: FUNDAMENTALS of PHYSICS, *Halliday & Resnick* 9th edition (with *Jearl Walker* !)
(the lab manual for physics 204A will be available for purchase at your first lab meeting)

1.*The Course:* Physics 204B is the second in a series of calculus based introductory courses intended primarily for students of physics and engineering. The course covers basic topics in the theory of electricity and magnetism comprising chapters 21-33 of the class text. Formal instruction includes three one-hour lectures and one three-hour lab each week. The tentative schedule of reading assignments and exams is contained on the attached sheet.

2.*Prerequisites:* Successful completion of Physics 204A or equivalent with a grade of C- or better. Credit for integral calculus.

3.*Homework:* Homework problems constitute a crucial part of the course (we operate according to the maxim "if you can't do the problems you don't understand the material"). We will proceed at about a chapter a week with new problem sets being handed out on Monday and collected a week later. Work is due in class and solutions will be posted immediately so that *no late work* can be accepted. Please submit your solutions on quadrille ruled paper using ☛ ***one side*** **of each sheet only!** ☚ The accompanying sheet "PROBLEM SOLVING GUIDELINES" outlines the general form and content of a 'good solution'. In a class this size, clarity and organization are crucial - accordingly any work I must 'fight to understand' will be summarily dismissed. Problem-set format should remain standardized and is also indicated in the guidelines.

4.*Exams:* Four one-hour exams and a comprehensive final exam will be given during the semester as indicated on the syllabus. Make up exams will not be given so be sure to mark your calendars. Each exam presupposes and builds on foregoing material - (this is the way physics is !) - so all exams will have a decidedly "comprehensive nature".

5.*Lab:* The three-hour lab meets weekly. A lab manual detailing the experiments may be purchased at the first lab meeting and should be consulted each week in preparation for the indicated exercise. Lab is considered a crucial part of the course so that *missing more than one lab and/or failure to submit a satisfactory write-up for more than one lab results in a non-passing grade for the course*. You must hand the labs in **on time** or fail the lab. A re-writing of the lab is permitted only with explicit **written** permission by the instructor and only then when the first write-up was initially submitted on time (i.e. a late lab is a failed lab). Missed labs should be made up the same week in another section. The onus for organizing this rests with the student.

6.*Grading the Course:* The final scores for 204B will be determined as follows:

Homework 12%
Lab 20%
Midterms(4) 12% each
Final 20%

The final assignment of letter grades is accomplished by finding the mean and standard deviation of the normalized net semester point totals. In general, the mean determines the B/C dividing line and one standard deviation on either side determines the onset of the neighboring grade. The instructor reserves the right to advance (never penalize!) any borderline grade on merit of performance or consideration of anomalous scores. If, due to budgetary considerations, the homework cannot receive full traditional grading, additional weight will accrue to the exams.

6.*Grading the Course (continued):* Throughout the course you are accumulating "points". In fact the *only* letter grade you will ever see is at the end of the semester. Notice that the Homework receives only 12% of the total weight in grading whereas doing the problems will constitute the lion's share of the work. This is unavoidable because most *learning* takes place in "the struggle" to learn how to do problems whereas *grading* must be based on achieved demonstrated competence alone. This class ameliorates the imbalance by instituting **"the basic social contract"** which runs as follows. All exam questions will be chosen from either: (1) the homework, (2) examples drawn from the text, (3) examples drawn from class discussion, or (4) examples drawn from lab discussion. Thus your class notes and homework solutions are also your private review material. Notice especially that, if you perform the ordinary class/lab work, you can rest assured that nothing unfamiliar will ever appear on any exam!

7.*Collaboration:* Working with others on homework or lab assignments can be a highly effective way to learn and is strongly encouraged. Collaboration on exams or plagiarizing the work of a colleague is strictly forbidden and will result in failure of this course and the full extent of any disciplinary action allowed by the University.

8.*Assistance:* At some point most students profit from some sort of directed problem solving. To this end you are encouraged to avail yourself of the various opportunities organized for this purpose.

a) The physics drop-in tutors (upper division physics students) are especially helpful and may be found in room 110 PHSC at the hours they post.

b) Physics 4Y is an optional regularly scheduled problem session for which you may receive 1 credit merely by showing up a minimal number of times. All are invited to participate whether or not you choose to receive credit, but please remember to register if you do.
Kagan sec. 10 TBA TBA PHSC 110

c) We as a class will choose, by common consent, one or more regular hours per week to meet and work on the problems informally. I designate these as my *problem solving office hours*. This tends to be a far more efficient and profitable tactic than having many students line up outside my office and then come in serially to ask the same question dozens of times. In addition, you are heartily encouraged to suggest any other scheme or arrangement that you judge would be of general profit to the class. We will discuss it and vote -- and, if at all possible, act accordingly. I will separately assign a time when you may freely come in unannounced to discuss any matter *other* than problem solving. I designate these my *administrative office hours*. Please try to honor the intent of each kind of office hour as it proves vastly more efficient for us all.

EXAMINATION PROTOCOL

All examinations will be conducted in an identical manner! You will receive a single sheet with the problems for your solution. You will then pick up a small sheaf of blank paper on which to write out your solutions to whatever length and detail *you* require to express your understanding. Each exam will contain the following header describing the general examination format:

< Please complete the following problems on the blank sheets provided using one side only. Please begin each new problem on a new blank sheet to provide good problem separation. Show all your work clearly and don't dwell too long on any one problem. Rather, complete first those that you understand better and return to any remaining problems at the end. Each problem is worth 20 points.
Be sure to work from fundamental equations only and indicate your derivations clearly. When you are done please label, initial, and number each sheet, then staple them all together in order and place them in the box provided. **No calculators and no notes of any kind are to be used. Please complete all your reasoning symbolically and express your solution as an algebraic expression available for numerical evaluation. >**

204B sections 5 and 6 **TENTATIVE SYLLABUS**

WEEK	DATE	CHAPTER / TOPIC	LAB
1	8/27	21 Electric Charge	Electrostatic Forces
2	9/3	22 Electric Fields	(labor day !)
3	9/10	23 Gauss' law	Millikan Oil drop
4	9/17	24 Potential	Electric Potential
**********9/21 *********		**First Exam (chap. 21-23)**	
5	9/24	25 Capacitance	Capacitors and Charge
6	10/1	26 Current and Resistance	Ohm's Law
7	10/8	27 Circuits	Resistor Circuits
8	10/15	28 Magnetic Fields	RC Circuits
********** 10/19 ********		**Second Exam (chap. 24-27)**	
9	10/22	29 Sources of Magnetism: Currents	e/m measurement
10	10/29	30 Sources of Magnetism: Induction	The Oscilloscope
11	11/5	30 Faraday's law & Induction	B Field mapping
12	11/12	31 AC Circuits	Earth's Field
**********11/16 *********		**Third Exam (chap. 28-30)**	
	11/19	*Fall Break*	
13	11/26	32 Maxwell's Equations	Induction lab
14	12/3	33 E & M Waves	LR Circuits
15	12/10	General Review	Driven LRC circuits
********** 12/14 *********		**Fourth Exam (chap. 30-32)**	

********** **12/19 (Wednesday) *** Final Exam** 10:00 AM**

PROBLEM SOLVING GUIDELINES

Effective problem solving *can be learned*! The ability to learn physics and then apply it to the solving of problems is greatly facilitated by acquiring good problem solving habits. The techniques listed below are employed by all experienced scientists - in nearly every problem! (This remarkable fact surfaced unexpectedly in recent American Physical Society studies of the 'problem solving process'.) I would like you to exercise these techniques and ask that any piece of written work you submit contain them - even if only in an "ever-so-abbreviated" form.

1.Draw a picture of the physical situation (before and after if appropriate). The picture should be about a half page in size – anything smaller is ***useless***. Often, an accurately drawn picture will immediately clear up your questions without further inquiry.

2.Identify your symbols - either by words or some reference (e.g. arrows) to your picture.

3.Identify your goal - i.e. a brief (even telegraphic !) description of what you're trying to achieve.

4.Identify all basic pertinent equations. Start from fundamental equations only - not special cases.

5.**Work the problem with symbols only**. Find a simplified *symbolic answer* - then - *only at the end*- substitute in numerical values for each symbol.

6.Check for correct units in your symbolic answer.

7.Check that your answer MAKES SENSE. This is usually done by sticking in values for the symbols in your symbolic answer for which the outcome is (roughly) known - and then observing that your solution does indeed give the expected result.

REMEMBER! Physics is about *relationships*. The whole point of modern science is that there are *very few* basic relationships indeed and that all other relationships spring from them. Thus, what we are interested in here is not just some numerical outcome or other but rather the understanding of how one arrives at the solution of a specific problem by starting from the (few!) basic relationships. Accordingly, the derivation and the algebraic form representing the final *relationship* are ***much*** more important than the simple numerical outcome. You are not "done" with a problem until your mind sees how that derivation proceeds. This is what we will mean by "completing a problem" and it is what I am looking for on exams.

****
****

FORMAT: Please use quadrille ruled engineering paper for all your solutions and use one side of each sheet only!. On the first page include your name, the date and the problem set number. Number all sheets in the upper right-hand corner using a "ratio" notation i.e. (page-number) / (total pages). Include at least your initials in the upper right corner as well. In general, each problem will require at least one full side (and usually more) to include all the above steps - don't stint on space!! - spread out. You are responsible for stapling your sheets together before class -! *Don't come to me!*

Grading homework problems. I use the 2 point grading scheme: 1-point is given for an accurate picture and correct assessment of the "kind" of problem at hand and for writing down the correct **fundamental** equations pertinent to this problem. The second point is given for correctly applying the general equations of physics to the specifics of the problem at hand and for successfully bringing the problem to algebraic completion.

Grading problems on exams. I use the 1-2-4-3 grading scheme: 1-point is given for an accurate picture and correct assessment of the "kind" of problem at hand, 2-points are given for writing down the correct **fundamental** equations pertinent to this problem, 4-points are given for correctly applying the general equations of physics to the specifics of the problem at hand, 3-points are given for successfully bringing the problem to algebraic completion. **NB!** If you should miraculously produce the correct numerical outcome of any problem but without the foregoing work being listed in detail…your answer will be accorded no points. Conversely, if you should correctly work your way through the algebraic solution but then carelessly substitute incorrect numerical values at the end, that solution will be accorded full (or nearly full) credit.

THE LAB NOTEBOOK

A good lab notebook is a useful and permanent working document. It may not be as polished as other pieces of work which you write several times before submitting - nonetheless, it should be characterized by a completeness, readability, and sturdiness of organization which allows profitable reference to it even after the passage of time. Once again, building good habits is the key - all successful scientists have them.

I. General Physical Description

✓ We ask that you use a spiral notebook with 8 1/2" x 11" quadrille ruled paper and that you number your pages for easy reference. Be sure to print your name, section number, *and* chosen lab time on the front of your lab book.

✓ Start the lab book off with a table of contents which you should update each time you undertake a new lab exercise. List the labs in order by title and the page numbers they occupy. Be sure to include the date you performed the data taking. You have completed a lab when I assign a permanent grade next to the lab listing in your table of contents.

II. The Lab Write-Up

Each lab will be represented by your *Rough Pages* and your *Formal Write-up*.

Rough Pages: Start each lab with a few 'rough pages' containing the **raw data** and **sketches** entered during the actual performance of the lab exercise. The rough pages are an important part of the lab book. The lab write-up proper will process this 'raw information' to produce your 'finished product' . .

➧ Now start the lab write-up proper with: ✓ the formal title of the lab, ✓ the date on which you wrote it up, and ✓ the names of the lab partners at your particular lab station with whom you performed the lab that day.

A good formal write-up will contain:

a) **An Abstract:** Your abstract will, in general, tell what "physical theory" is being placed under scrutiny and the general scheme of how you intend to do that (usually the demonstrated validity of some proposed relationship/equation). (1 point)

b) **Theory Section:** In this section you will ***derive*** the working equations (the equations you actually use) from fundamental equations. In the later labs you will also ***derive*** your working uncertainty formulae from fundamental expressions. It is important, here, to clearly point out ***exactly*** where the act(s) of comparison between theory and measurement will take place. (2 points)

c) **Procedure and Apparatus:** Include rough but complete sketches of apparatus and a brief description of how you took data. I suggest that, at this point, you also include necessary sizes and masses etc. in your sketches. (1 point)

d) **Data *Tables*:** A record of relevant data taken - written in table form. Include units and make your tables spacious. (2 points)

e) **Analysis:** Analysis of the data along with estimation of uncertainties. This is the place you employ your working equations and present your results in a form available for easy comparison. In many cases you will include either a graph with multiple curves or a final table with the most crucial values to be compared placed side by side (2 points)

f) **Evaluation and Conclusion**: In general this will be the comparison between measured and predicted results – and the evaluation. The prime question to answer each time is: *Did the predictions agree with the measurements **within uncertainty**?* You will, *almost always*, want to summarize the pivotal comparison values in a small **final table**.(2 points)

_____
10 points total

204B Lab Record

Name: _____

Section & Semester: _____

	Title	***Lab-book pages***	***Lab--date***	***Write up--date***	***Grade***
1	**Electrostatic Forces**				
2	**Millikan Oil Drop**				
3	**Electric Potential**				
4	**Capacitors**				
5	**Ohm's Law**				
6	**Resistor Circuits**				
7	**RC Circuits**				
8	**e/m Measurement**				
9	**Oscilloscope**				
10	**B Field Mapping**				
11	**Earth's Field**				
12	**Induction Lab**				
13	**LR circuits**				
14	**Driven LRC circuits**				