Course Syllabus

PHYS 3416 Electricity & Magnetism Fall 2007

Professor Contact Information

Instructor:	Paul MacAlevey
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The 28 meetings of the class (inclusive of midterm tests) will be on Mondays and Wednesdays in FN 2.106 from 10:30 AM to 11:45 AM.

Course Pre-requisites, Co-requisites, and/or Other Restrictions:

You need to have done:
PHYS 3311 Theoretical Physics (or equivalent).

Office hours: instructor: Monday and Wednesday 2:00-3:00 or by appointment.

I am quite happy to see you at these times. However, I do not use office hours just for the purposes of distributing hints to homework problems. If I am asked about a homework problem then my response will be to ask you what you have done. (Vague answers won't do. Expect me to ask you to write something.) I don't intend to do your homework for you. I expect that we will arrive at something to try. After talking to me, I expect that you have enough to go about solving the problem yourself!

TA: contact information: TBA office hours: TBA

Course Description:

1. Vector Analysis

I intend to begin with Dirac's Delta 'Function' as much of the material before this has been done in 3311. It is important that you quickly read the earlier sections though: Different authors have their preferred notation etc. and we have to be able to recognize it. (eg. In 1.4.2 the distance from the field point to the z – axis is called *s*. [I might have called it ρ in 3311]. Also, the relative position of a point at $\vec{r}$ and the field point at $\vec{r}'$ is $\vec{r}$ - $\vec{r}'$ which he denotes $\vec{\boldsymbol{\varkappa}} \equiv \vec{r}$ - $\vec{r}'$ …etc.). Expect to have to use this material in the solving of problems in homework or tests.

The Theory of Vector Fields is a useful place to talk about Helmholtz theorem and introduce two types of potential.

2. Electrostatics

We could just talk about Coulomb's law but our use of the Electrostatic Field lets us avoid action-at-a-distance.

The Divergence and Curl of Electrostatic Fields allows us to build up to Gauss's law. This law can allow us to calculate the magnitude of the electric field when superposition gives us integrals that are hard to do.

Evaluating the Electric Potential allows us to write down the electrostatic energy of a distribution of charges.

3. Special Techniques

A very useful feature of the electrostatic potential is that it can be found from Laplace's equation (or Poisson's) equation. The electric field can be found by integrating this potential. The Method of Images is one way to 'guess' the solution of Laplace's equation but the method of separation of variables (that you saw in 3311) is often more useful (albeit longer).

We can always find the fields due to simple collections of point charges (monopoles, dipoles, quadrupoles etc.). No matter how many of these we consider, we never quite get to a 'realistic' distribution of charge. Has our work been wasted? No. We can decompose any 'realistic' distribution into 'components' that behave like monopoles, dipoles etc. Roughly speaking, this is what Multipole Expansions are about.

4. Electrostatic Fields in Matter

Charges separate even when a neutral atom is put in an electric field-an effect called polarization. This causes another electric field which in turn causes more polarization etc. The resulting field is called the Electric Displacement. Linear Dielectrics/insulators are dielectrics for which the electric displacement depends linearly on the electric field. (Recall Hooke's law…) Most dielectrics are linear when the external electric field is weak.

5. Magnetostatics

At first, magnetism seems to be entirely distinct from electrostatics. (Really, magnetism is a relativistic effect caused by electric charges cf. section 12.3; Relativistic Electrodynamics.) In any single reference frame, an observer will see two distinct phenomena; electricity and magnetism. Until the implications of special relativity were understood, magnetism was developed from the Lorentz Force law. Bîot and Savart related the magnitude and direction of steady currents to the fields that the currents produce. The Divergence and Curl of the magnetic field are looked at by analogy with our looking at the divergence and curl of the electric field in chapter two. This allows us to introduce Vector Potentials for magnetic fields.

6. Magnetic Fields in Matter

The polarization caused by a given electric field depends on the substance in which it exists. The same is also true of the magnetization caused by a given magnetic field. Just as we introduced a field called the displacement field caused by an electric field in matter, so too we introduce an auxiliary field H that results from an externally applied magnetic field. Linear Media are those for which the auxiliary field depends linearly on the applied magnetic field….

7. Electrodynamics

Up to this point, the book has been dealing with static electric and magnetic fields. "Electromotive Force" causes electric charges to move but rather than be analogs, the electric and magnetic fields begin to appear together when we look at electromagnetic induction. Maxwell's Equations (plus boundary conditions plus Lorentz force law) summarizes all of electrodynamics in an economical way.

Student Learning Objectives/Outcomes:

- Given a boundary-value problem, students will separate variables to find an electrostatic potential
- Given a (symmetric) physical situation, students will find electric fields using Gauss's theorem and image theory
- Given the theory of electrostatics in vacuum, students will define an electric displacement field so that the theory can deal with linearly polarizable materials. Analogously, given the theory of magnetostatics in vacuum, students will define a field $\vec{H}$ so that the theory can deal with linearly magnetizable materials.
- Students will find an inconstancy in Ampère's law for constant currents. They will fix Ampère's law using the preservation of the continuity as a guide

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Required Textbooks and Materials:

We will use the book; "Introduction to Electrodynamics" by David Griffiths, (Prentice Hall) ISBN: 0-13-805326-X. (You can get it at the campus bookstore, off-campus books, Amazon.com or half.com etc…. I don't mind if you buy it new or used but I think that it is worth thinking about keeping the book if you will be doing more Physics courses.)

Please make an effort to get the book quickly. I will be assigning homework from it and assume that you have access to it from the beginning of classes.

I do not require you to buy another textbook but, if I were you, I'd make good use of the book by Boas. Another electromagnetism book that I hear good things about is "Electromagnetism" by G. Pollack and D. Stump, (Addison-Wesley) ISBN 0-8053-8567-3.

Suggested Course Materials:

You should have a calculator, pencil and pen at all meetings of the class. (The calculator need only be a 'scientific' one.)

Assignments & Academic Calendar:

Homework in this class takes the form of doing sets of questions. I intend to send you an e-mail (on WebCT) on Monday evenings. This will have the numbers of questions whose answers are **due at the beginning of class** on the **Wednesday nine days later.** However, please don't wait for me to formally assign homework before you begin on the questions. As soon as sections 2.1 and 2.2 have come up in class, consider problems 2.5, 2.10 and 2.14 to have been assigned etc.

Begin your homework as soon as you can because many problems are too difficult for a last-minute effort. Work out homework roughly before writing out a 'clean' version for submission as homework. The final version should explain what you are doing and not just contain algebra. It should be written on paper with neat edges (rather than being on pages that are torn out of a spiral notebook. **Scratched out answers, partial erasing etc. is unacceptable**. I**f your work can't be read then you should not expect much credit**.

- **Draw a diagram**. (This often helps you think about the problem.)
- **Your solution should explain what you are trying to do**
- Begin a new problem on a new page.
- There should be no scratched out work or partial erasing. The solution that is submitted for grading should be written on paper with neat edges. I may return such work to you for rewriting and resubmission
- Define any symbols that you use

Please **staple** your homework together. Loose pages get lost among a pile of papers. Paperclips have their uses but they aren't very good at staying attached when in a pile of other papers.

Doing homework is an important part of the learning process. When writing a solution, it is especially important to write comments that explain both what you are trying to do and how you are trying to achieve it. **At any point during the semester, I will feel free to ask any member of the class to explain any aspect of a homework problem to me**.

The numbers of the homework questions are:

Section	Question
p xi, 1.4, 1.5, 1.6	1.4, 1.6, 1.8, 1.13, 1.20, 1.26, 1.35
2.1, 2.2	2.5, 2.10, 2.14
2.3, 2.4, 2.5	2.21, 2.25, 2.28, 2.30, 2.32
3.1, 3.2	3.2, 3.4, 3.6
3.3	3.12, 3.14, 3.18
3.4	3.28
4.1	4.4, 4.5
4.2	4.11, 4.14
4.3, 4.4	4.15, 4.18, 4.22, 4.24, 4.26, 4.28
5.1	5.1, 5.7
5.2	5.11
5.4	5.22, 5.25, 5.35, 5.36
6.1	6.1, 6.4, 6.6
6.2	6.9
6.3	6.12

6.4	6.17, 6.20
7.1	7.5, 7.7
7.2	7.14, 7.18, 7.24, 7.29
7.3	7.31, 7.32, 7.35

The TA will collect the homework that is due and return graded homework not less than one week later. I intend to post solutions on the WebCT site after the due date. **Late homework is not accepted.**

To use WebCT, you have to have a login ID/WebCT ID and password. The WebCT server is at http://webct6utdallas.edu. The solutions are protected with a password and can be opened with Acrobat 5 or later http://www.adobe.com/products/acrobat/readstep2.html. The password is **methods**. It is intended that the solutions get you 'on the right track' that you will follow to produce a complete solution. If you have any hard-copy solutions to problems in this book, then I suggest that you destroy them. Retaining solutions as a substitute for doing a problem yourself almost guarantees poor performance on exams.

You will also need to **check the preferences used by your browser** from the 'check browser' link on the first page that you get after log-into WebCT. (WebCT uses pop-ups intensively. Use your internet options to make the site a 'trusted site'.)

Reading Quizzes:

The best book in the world won't help if you don't read it. I am going to give **reading quizzes**. I do not expect you to master the material on your own but I do expect you to read the sections that are assigned and know the terminology that is used in those sections. I'll expect that you know what is (and what is not) discussed in various sections so that discussion in lecture can proceed without line-by-line repetition of the text. Please be on time: **the reading quizzes cannot be made-up if missed**. Some will be dropped in the calculation of your course grade.

The following schedule is tentative and the timing may be changed as we move on. However, the dates for the midterms will not change. **It is helpful for you to stay ahead in your reading**.

Tentative Schedule for Reading Quizzes

Date	Meeting	Assigned Reading
Monday Aug 20	1	intro
Wednesday Aug 22	2	p xi, 1.4, 1.5, 1.6
Monday Aug 27	3	2.1, 2.2
Wednesday Aug 29	4	2.3, 2.4, 2.5
Monday Sept 3		**Labor Day – no class**
Wednesday Sept 5	5	3.1
Monday Sept 10	6	3.2

Wednesday Sept 12	7	3.3
Monday Sept 17	8	3.4
Wednesday Sept 19	9	4.1
Monday Sept 24	10	4.2
Wednesday Sept 26	11	4.3
Monday Oct 1	12	**First midterm 1 - 3**
Wednesday Oct 3	13	4.4
Monday Oct 8	14	5.1
Wednesday Oct 10	15	5.2
Monday Oct 15	16	5.3
Wednesday Oct 17	17	5.4
Monday Oct 22	18	5.4
Wednesday Oct 24	19	6.1
Monday Oct 29	20	6.2
Wednesday Oct 31	21	**Second midterm 1 - 5**
Monday Nov 5	22	6.3
Wednesday Nov 7	23	6.4
Monday Nov 12	24	7.1
Wednesday Nov 14	25	7.2.1, 7.2.2
Monday Nov 19	26	7.2.3, 7.2.4
Wednesday Nov 21	27	7.3.1, 7.3.2, 7.3.3
Monday Nov 26	28	7.3.4, 7.3.5, 7.3.6
Friday Nov 30		**Final 8:00 AM**

The University arranges the final exam. Please look at http://www.utdallas.edu/student/registrar/finals/ **to check the scheduled time just before this exam**.

Grading Policy:

I intend to use a grade scale as follows. If x is a score then,

$x \geq 95$	A+
$95 > x \geq 90$	A
$90 > x \geq 85$	A-
$85 > x \geq 75$	B+
$75 > x \geq 65$	B
$65 > x \geq 60$	B-
$60 > x \geq 55$	C+
$55 > x \geq 50$	C
$50 > x \geq 45$	C-
$45 > x \geq 40$	D+
$40 > x \geq 35$	D
$35 > x \geq 30$	D-

30 > *x*	F

Weighting:

The course grade will be the average of the homework, the scores in each of the midterm test and the score in the final. These averages will be weighted as follows

Homework	15%
Reading Quizzes	10%
Midterm I	20%
Midterm II	20%
Final Exam	35%

I do not intend to use a curve in my grading of tests. A grade of X (incomplete) is awarded if an unforeseen, non-academic emergency prevents a student from completing the work in a course. If a student wants to discontinue the course because a poor grade is expected, it is nearly always more appropriate for the student to withdraw from the course and re-register in another semester. If an incomplete is given, the course must be completed within eight weeks of the first class day of the next long semester.

In general my tests are 'closed book' and 'closed notes'. I tend to embed reference material and some long equations in my tests. I have found that the main difficulty with tests is not with remembering equations (though this helps!) but in knowing how to use them. **All books, notes, backpacks, cell phones etc. are to be placed by the sides of the room during a test**. (By the way, don't spend too long erasing mistakes when writing answers to **test** questions. Begin again and **label the correct version** so that I can find it. Versions that you can't get to work may tell me something.)

Use of scientific calculators is allowed on tests. However, graphing and programmable calculators are not allowed. None of the test questions that I ask will involve lots of number crunching. **Valid UT-D student cards must be available if requested during tests**. (You can get one made and stamped/validated at the info depot in the student union building; SU 2.204.)

Missed tests can only be made up in the case of documented, extenuating circumstances. Such circumstances include medical emergencies and work-related travel that cannot be re-scheduled.

Course & Instructor Policies

Doing homework is an important part of the learning process. **Feel free to form study groups etc**. However, it is important to **hand in work that is your own**. When writing an answer to a question, it is important to write comments that explain both what you are trying to do and how you are trying to achieve it. In addition to the homework problems that are handed in for grading, I may suggest that you work problems other than homework problems. These are worth looking at as they improve your ability to solve problems.

In addition to helping you become familiar with the material, the homework will include problems that have longer solutions than problems on a test. Begin your homework when it is assigned; many problems are too difficult for a last-minute effort. When grading your work, the grader will be trying to understand your reasoning. Help him/her by saying what you are trying to do! Homework with no comments or partly scratched out answers don't help you show this. For grading, present neat versions of your solutions to the TA. Answers that are indecipherable will not attract much credit. If needed, **I may ask any student to explain their work to me.**

Dishonesty:

I would like to emphasize a point about the use of secondary sources etc. I do not object to people discussing problems that they have already attempted**. I do not object to the use of any other textbooks that you come across.** I object strongly to any verbatim, unacknowledged work done by anyone other than you and presented as part of your work**. (This includes any passages from textbooks, any solutions that you come across in hard copy or on WebCT etc. It also includes work produced by any other member of the class [past or present]). Every student in the course agrees to this limitation. Further, all students agree to tell me the source of any solution to any problem assigned in PHYS 3311 that they know about. No materials posted on the WebCT site become the property of the student. At the conclusion of the course, all students undertake to either keep all course materials** (posted solutions, graded homework etc.) **for their exclusive use. Any distribution of course materials to third parties constitutes academic dishonesty and will be reported to the Dean of Students**

In order to further the objective of eliminating scholastic dishonesty, the University has a policy on scholastic dishonesty. This policy is clearly articulated in Subchapter F section 49.36 of the policy on student discipline & conduct adopted by the University and used in this course. The full chapter 49 is at http://www.utdallas.edu/student/slife/chapter49.html Students enrolling in the course are bound by this policy and are encouraged to read it. Any questions about this policy can be asked of the Dean of Students. **Any suspected cases of scholastic dishonesty will be passed along to the Dean of Students**.

Students are welcome to ask questions of my TA or me about homework problems. However, I do not authorize these students to communicate such discussions to other students. These other students are welcome to ask me questions too.

The WebCT site contains postings exclusively for the use of the person with the privilege accessing the site. Materials on this site form another secondary source that is intended to help students in my class during the semester that the posting is made. No materials posted on the WebCT site become the property of a student. **Students acknowledge that distribution/transmission of any posting made on the WebCT site constitutes scholastic dishonesty**. (See parts (d) 1 and (d) 5 of section 49.36 of the policy on student discipline & conduct.)

The question about WebCT can be extended. I will treat in the same way any pre-existing solution to a problem assigned as homework in a previous semester, a solution to a problem asked on a test, or any problem from the book. As soon as any student in this course comes across any kind of pre-existing solution, that student must inform me of its existence and source. To do

otherwise is to aid copying. (See part d (1) of section 49.36.) In order to maintain privacy, I can be contacted by e-mail if desired.

A note about missing classes

First of all, please try not to! **If something arises that prevents you from attending class, please inform me as to why by e-mail**. Not everything that we do in class is covered in any single textbook. If there were an ideal textbook for us then there would be little or no need for classes. An ideal textbook does not exist. By missing class, you will miss either something not covered by the book that you are reading, or you will miss 'intermediate steps' in an author's argument that will help you follow along. You also pass up the opportunity to ask questions of your own and miss out on hearing the questions of others. (This latter point is significant. Other students may ask questions that haven't occurred to you yet and hence develop your understanding of the subject.)

If you **have** to miss class for some reason then it is your responsibility to get class notes or handouts given in class. Please do this quickly after your absence. (I'm not keeping tabs on your attendance and leave some of the responsibility to you.) In order to understand the next lecture given, you will need to have obtained and worked through any notes etc. from the previous lecture. I give lectures from 'outline notes' that are probably not what you want to read. If you miss a lecture then your best source of class notes is another student who wrote down exactly what we actually did.

I return graded homework and tests primarily in class. Again, you'll miss this if you are absent from class. After I have tried to return the graded work to you a class from which you were absent, the responsibility for getting it from me becomes yours.

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30 a.m. to 6:30 p.m.; Tuesday and Wednesday, 8:30 a.m. to 7:30 p.m.; and Friday, 8:30 a.m. to 5:30 p.m.

The contact information for the Office of Disability Services is:
The University of Texas at Dallas, SU 22
PO Box 830688
Richardson, Texas 75083-0688
(972) 883-2098 (voice or TTY)

Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

These descriptions and timelines are subject to change at the discretion of the Professor.