PHYS 3311.501 Theoretical Physics Spring 2006

This class meets in the Classroom Building CB 1.122 on Monday and Wednesday from 5:30 to 6:45. There will be 28 lectures including both midterm tests (but excluding the final).

I will send e-mail to UTD e-mail addresses only. Regulations prevent me from sending some information to any other e-mail address.

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Office hours: Monday and Wednesday 2:15 to 3:15 Founders Building 2.708B or by appointment. E-mail may prove useful for asking questions. I would like to able to communicate with you easily so **please send me your UTD e-mail address today**! **(If you want to use another address, go to https://www.netid.utdallas.edu and have your UTD mail forwarded to the account that you want to use.**)
During the semester I may make comments, changes to homework assignments etc. and will write to those who have sent me an e-mail address.

TA: Geoff Ussery FO 1.424 geoffrey.ussery@student.utdallas.edu

Overview:

This semester, I'll begin with Complex Numbers (Chapter 2) and then move on to linear algebra (Chapter 3). That chapter introduces some 'index notation'. This notation is very useful in proving vector identities later on and I'll dip into Chapter 10 where necessary. I'll skip Chapter 4 as it has already been covered in calculus II (MATH 2419). Some of the material in these early chapters will be familiar. However, you will want a deeper understanding of it and a facility with it that will help you move on to more advanced topics. While you are covering these sections, I expect you to solve many of the problems posed in the book.

We will spend time on 'Classical Vector Analysis' and the vector integral theorems. (You'll constantly be meeting grad, div and curl in other Physics courses.)

Expansion of functions in series is an important idea in Physics. Not all physically interesting functions have 'nice' properties (such as being continuous). Expansion of functions as power series assumes that that they are 'well behaved'. An important topic is the representation of physically interesting functions that aren't so 'well behaved'. Surprisingly, this can often be done by writing a function as the sum of a series of *sines* and *cosines* -- a Fourier Series. We'll see how to do this in Chapter 7.

Many physical phenomena involve solutions of a Partial Differential Equation (Chapter 13). If the PDE governing the phenomenon is known, it is of immediate interest to solve the equation. We look at a technique that separates a PDE in N variables into N ODEs. Finding the solution to a PDE thus involves finding the solutions to the N ODEs. We will use this technique in Cartesian coordinates in the first sections of Chapter 13.

While you are familiar with some ODEs, other ones arise in connection with separation of variables in other coordinate systems. Chapter 12 is necessary to examine these ODEs and their solutions before we can continue with Chapter 13. Fortunately, many of these ODEs can be solved using a slightly modified power series. We will then finish Chapter 13 and our study of PDEs.

Pre/Co-requisites:

You need to have done:

MATH 2451 (Multivariable Calculus with Applications) or equivalent,
PHYS 2326 Electromagnetism and Waves

You need to be doing:

MATH 2420 (Differential Equations with Applications) or equivalent,

Textbook:

We will use the book **"Mathematical Methods in the Physical Sciences"** (third edition) by Mary L. Boas **3rd Edition**, ISBN: 0-471-19826-9. (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 before the class meets. I will be assigning homework from it and assume that you have access to it from the beginning of classes. **I usually assign homework by e-mail and will send to your UTD address. (If you prefer to use another e-mail inbox, you can go to https://www.netid.utdallas.edu and have your UTD mail forwarded to the account that you want to use.**

Grading:

Homework	15%
First midterm test	25%
Second midterm test	25%
Final Exam	35%

I do not intend to use a curve in my grading of individual tests. I'll begin with a simple set of grade-boundaries; if x is a score,

$x >= 85$	A
$85 > x >= 70$	B
$70 > x >= 55$	C
$55 > x >= 40$	D

Plus/minus grades will be added later (Roughly speaking, they will be at 5% intervals.) These grade boundaries are a starting point. I reserve the right to be generous to the class as a whole

Homework:

This will be **assigned by e-mail** on a Tuesday and will be **due** at the **beginning of class** on the **Thursday nine days later**. (There is a provisional list of homework later in this syllabus.) Since I

want to get solutions posted before a test, I will not accept any late homework for the homework that is assigned just before a test. 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. There should be no scratched out work or partial erasing. It should be written on paper with neat edges (rather than being on pages that are torn out of a spiral notebook.

Please explain any algebraic steps that you make in your homework problems. Somebody (maybe me!), will be trying to read your work. **If we can't read it then you should not expect much credit**. 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.

Begin your homework when it is assigned; many problems are too difficult for a last-minute effort. If your work cannot be readily understood then it will not attract much credit. **Help by saying what you are trying to do! Scratched out answers, partial erasing etc. is unacceptable**. Present neat versions of your solutions for grading. **Staple** you homework together. Please don't use paperclips or present us with loose pages.

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 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.

Late homework:

Homework is due at the beginning of class on the day mentioned. Late homework will only be accepted if a TA is assigned to the course. Any later submissions may be counted as late. Please do homework on time but here is my policy on late homework.

1 class late	graded out of 60%
2 classes late	zero

Tests:

Test questions may differ from homework questions

- Given that time is limited, problems on tests can be shorter than the longest homework problems.
- Test questions will also ask you to derive certain results etc. just as we see in class. These items are chosen to check on understanding of important material.

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.) **All tests will be done with books and notes closed**. Calculators other than those with significant amounts of memory are allowed on tests or exams.

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.

The final exam will be comprehensive and may include questions on any section listed in the schedule.

The schedule for the course may be changed as the course proceeds. However, the dates given for either midterm won't change (even if the topics on the test do).

Scholastic dishonesty:

Of great importance to you as a student is that others perceive your degree as having value. That value is diminished if others suspect that a degree can be obtained through dishonest means. As your instructor, academic dishonesty gives me a false picture of the capabilities of the individual that is being dishonest. In a wider context, it gives me a false picture of what can be reasonably expected of my students.

In order to further the objective of eliminating scholastic dishonesty, the University has a policy on scholastic dishonesty for several reasons. 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**.

Semester dates:

Jan 9 to May 3. The last class day in April 24

Last day to drop a class without a "W"... Wed., January 25
WP or WF withdrawal period
begins……..…Mon., February 13
last day to withdraw with
WP/WF……..…Thurs., March 16

The final is scheduled by the University to be at 5:00 on Wednesday, April 26th. (Note that this time is not the usual class time. Please check this date and time just before the exam at www.utdallas.edu/student/registrar/finals/finals06S.pdf .)

HOMEWORK FOR 3311

The first question on set one is 2.5.9 and is worth three points. The fifth question on set 2 is 2.9.37 and is worth four points.

Chapter 2

Set 1:

5.9 (3), 15 (6), 24 (9), 27 (3), 47 (18), 56 (9), 67 (18),

Set 2:

6.11 (9),
7.8 (3),
8.2 (6),
9.19 (4), 37 (4),
11.7 (4), 12 (12),
12.31 (9),

Chapter 3

Set 3:

3.6 [Indicate the row operations that you use] (9),
7.5 (4), 13 a (6),
9.3 (18), 13 (9), 14 (9), 18 (9)

Chapter 5

Set 4:

3.2 (9), 5 (12), 6 (18), 31 (9),
4.2 (9) this is long!, 7 (18), 13 (9), 20 (18),
5.2 (24),

Chapter 6

Set 5:

6.8 (12), 15 (12)
7.3 (6), 8 (6), 15 (6), 20 (12),

Set 6:

8.6 (12), 13 (12), 17 (12),
9.3 (6), 9 (18),

Set 7:

10.6 (6), 11 (4), 16 (9),
11.8 (9), 9 (9), 11 (9), 17a to d (30), 22 (24),

Chapter 7

Set 8:

4.1 (18), 12 (12), 16 (12),
5.6 (24)
7.2 (18), 7 (16)
8.2 (12),

Set 9:

9.2 (8), 13 (12), 21 (16)
10.2 (9), 8 (8),
11.5 (8), 6 (4), 10 (6)

Chapter 13

Set 10:

1.2 a (9),
2.2 (12), 14 (18), 16 (12),
3.2 (18), 8 (18),
4.1 (18), 2 (9), 5 (12),

Chapter 12

Set 11:

1.8 (18)
2.2 (6),
11.2 (18), 11.10 (24)
12.1 (9),

I intend to post solutions to homework on WebCT at http://webct.utdallas.edu . You need a UTD computer account to use this site. Please get one and make sure that your browser can access the WebCT site. To use WebCT:

- You have to have a loginID/WebCT ID and password. If you haven't got one, take your UT-D student ID to the computer call center (JO 3.536) and ask for a UT-D computer account. It will take at least a day for your account to become active so **order this computer account as soon as possible!**
- You will need to **check the preferences used by your browser** by going to http://www.utdallas.edu/distlearn/students/support.htm
- The Center for On-line Learning and Technology manages the WebCT server at UTD. Contact them if you have difficulties using WebCT. Their homepage is http://www.utdallas.edu/distlearn/students/index.htm. (By the way, I do not use the 'mail' feature of WebCT. If you want to send me an e-mail the please use paulmac@utdallas.edu.)

Sometimes I attach Word files to my e-mails (or embed equations in the e-mail). To get equations to display, install the Equation Editor from the MS Office disk. [Unfortunately, it is not part of the 'typical installation'.] To get the fonts for all symbols that I use, you need to you need to also download the font installer (free) from http://www.dessci.com/en/dl/fonts/getfont.asp. (You shouldn't be without

Adobe's free PDF reader available from their site at
http://www.adobe.com/products/acrobat/readstep2.html.)

A **tentative** schedule for the course is as follows;

Date	lecture	Aims
Monday Jan 9	1	2.5
Wednesday Jan 11	2	2.6 – 2.9, 2.11, 2.12
Monday Jan 16		*Martin Luther King Jr. Day*
Wednesday Jan 18	3	3.1 - 3.3, 3.6
Monday Jan 23	4	3.7, 3.9
Wednesday Jan 25	5	10.1 - 3
Monday Jan 30	6	3.11, 3.12
Wednesday Feb 1	7	5.3
Monday Feb 6	8	5.4 – 5.5
Wednesday Feb 8	9	10.4, 10.5
Monday Feb 13	10	6.4, 6.6, 6.7
Wednesday Feb 15	11	6.8, 6.9
Monday Feb 20	12	**First Midterm**
Wednesday Feb 22	13	6.11
Monday Feb 27	14	6.10
Wednesday Mar 1	15	3.8, 3.10, 3.14
Monday Mar 6		*Enjoy Spring Break!*
Wednesday Mar 8		*Enjoy Spring Break!*
Monday Mar 13	16	7.1, 7.3 - 7.4
Wednesday Mar 15	17	7.5, 7.6
Monday Mar 20	18	7.7, 7.8
Wednesday Mar 22	19	7.9, 7.10
Monday Mar 27	20	7.11
Wednesday Mar 29	21	**Second Midterm**
Monday Apr 3	22	13.1
Wednesday Apr 5	23	13.2
Monday Apr 10	24	13.3
Wednesday Apr 12	25	13.4, 12.1
Monday Apr 17	26	12.2+
Wednesday Apr 19	27	13.5
Monday Apr 24	28	13.6
Wednesday Apr 26	**Final (comprehensive)**	