UNIVERSITY OF MARYLAND, College Park

Spring 2020 Physics 274: Mathematical Methods for Physics I Prof. B L Hu

Description: This course is the first of a two semester sequence (274-373) on mathematical methods for physics intended for physics majors and those desiring a rigorous preparation in the physical sciences. Topics include linear algebra, curvilinear coordinates, vector analysis and Dirac functions.
Prerequisites: PHYS272 and MATH241. http://www.ugst.umd.edu/courserelatedpolicies.html

Lectures: MWF 2:00pm - 2:50pm, in Symons Hall 0200. 1st lecture Jan 27, last lecture Mon May 11.
Lecturer: **Prof. B. L. Hu**, Office: PSC3153, Phone: (301) 405-6029, Email: blhu@umd.edu Mailbox #425
Office hours: MW1-2pm (many seminars are at 3pm). Please email me ahead of time if you intend to come.
Note: Do not leave any material in my office. If you have late homework, first seek my approval with a good reason, then put it in the TA's mailbox # 424 in Toll Bldg.
TA: **Mr. Thomas Longo** Office: 1103 IPST (next to PSC) Office hours: Tu Th1-2pm. Communication via ELMS or email: tlongo1@terpmail.umd.edu Cell phone (603) 953-5986 is for matters of urgency only.

Textbooks:
Required: Mary L. Boas, Mathematical Methods in the Physical Sciences, 3e (Wiley 2006)
Errata: Corrections and Minor Revisions of Mathematical Methods in the ...
Spiegel, Lipschutz and Spellman, *Vector Analysis 2nd* ed Schaum's Outlines (many useful examples)
Recommended:
R. Snieder and K. van Wijk, *A Guided Tour of Mathematical Methods for the Physical Sciences* 3rd ed (Cambridge University Press 2015)
Lay Lay & McDonald, *Linear Algebra and Its Applications* 5th ed (Pearson 2016)

Reading: The main subjects and the approximate progression of topics are listed in the Course Contents below. Readings of specific sections in the textbooks will be announced in class as we progress. To enhance your comprehension of a particular subject to be covered in class, *try to read the material in the textbooks before coming to the lecture*. This will enable you to ask questions about ideas you may not grasp fully on a first reading and to gain a better overall perspective. Read it again after the lecture, study the examples and do the assigned problems. I encourage questions in class (to the extent time permitting, but that can be followed up in my office hours) – this could stimulate thoughts and discussions.

Course webpage: Please check for new announcements, adjustment of topics or due dates in the course website at ELMS/CANVAS system: www.elms.umd.edu/page/student-support where you will also be able to access your exam grades. For questions call the Help Desk at 301.405.1500 or email elms@umd.edu.

Homework: 12 sets of homework problems are planned. They are to be worked out and handed in at the beginning of classes on the due dates (usually Fridays) -- check the course webpage for last minute changes. Solutions will be posted soon after, thus no late homework will be accepted. I encourage group discussions but stress strongly **the importance of thinking through and working out the problems on your own**. *Don't rely on others' help or just passively read the solutions.* Homework is essential to your mastering a subject and the effort you put in to it will be reflected clearly in your examination performance.
Grading scheme : Each homework has 6 problems worth a total of 16 HW pts: 1 problem worth 6 points will be selected to be graded in detail. Each of the remaining 5 problems is worth 2 points. The best 10 sets are counted toward a total of 160 points in the course score.

Note: Copying solutions from any source **is considered as plagiarism,** a form of academic dishonesty. This includes also partial consultation of published solutions. See University policy below for consequences. This act can easily be detected by an experienced eye. More importantly, doing so will rid yourself of the precious experience of *learning through thinking and retaining through practice*. **It will definitely hurt your performance in examinations.** Thus, treat each homework as an open book exam and refuse help from anyone or any other sources. Discipline yourself in this routine. You will see the progress. After you have handed in your homework, make sure you *use the posted solutions to check on what you did wrong, rework those problems till you get them right.* Make this a habit.

Mid-Term Exams: Two 50-minute closed book mid-term exams are scheduled on **Friday March 6** and **Wed April 8** during the lecture periods. They are likely to contain one or more problems based on the assigned homework problems. Each exam counts 100 points. **Please make all necessary preparations and arrangements to ensure you can take these exams because no make-up exam will be given**.

The Final Exam held on **Monday, May 18 @ 1:30-3:30pm** in class is worth 240 points. It is comprehensive, with proportionately more materials since the second midterm exam. University rule requires all students must take the final exam to receive a course grade, otherwise your course grade will automatically be an F.

Exams are meant to test your understanding and ability to apply concepts covered in the course, not how well you can memorize the formulas or course materials. You may bring one 4x6" formulas card, written on both sides, to each exam. Keep these 2 cards for the 2 midterm exams. Add 1 new card for a total of 3 cards for the final exam. Formula cards are only for formulas, do not put down any **derivations**, or your exam problems which ask for such derivations will be automatically annulled. Please insert your formula card(s) into your exam paper when you hand it in. The values of constants and useful integrals will be provided. Only a non-programmable calculator with standard trigonometry function is allowed, no smart phones, PCs, I-Pads etc. Please turn off your cell phone or other communication devices during the exam.

Academic dishonesty is a serious violation and will be dealt with strictly, according to University policy.

Course Grade: Your course grade is based on the total course score (max 600) made up in the composition of 160 points homework, 200 points for the 2 mid-term exams, and 240 points from your final exam scores.

10 best Homework sets out of 12 sets	160 points
2 Midterm Exams	200 points
1 Final Exam	240 points
Total Course Score:	600 points

Academic Integrity: The university has approved a code of academic integrity available on the web. The code prohibits students from cheating on exams, plagiarizing papers, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents, or forging signatures. The university senate requires that students include the following signed statement on each examination or assignment: I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment). Compliance with the code is administered by a student honor council, which strives to promote a community of trust on the College Park campus. Allegations of academic dishonesty may be reported directly to the honor council (301-314-9154) by any member of the campus community.

Course Contents:

Linear Algebra (~ 8-9 weeks) Mainly Boas, supplemented by Lay et al
Linear vector spaces; linear operators and their representation as matrices; matrix algebra; determinants and their applications to the solution of linear inhomogeneous equations; inner products; eigenvalues and eigenfunctions with applications to physics problems; infinite dimensional vector spaces.

Curvilinear Coordinates and Vector Analysis (~ 4 weeks) Mainly Snieder, supplemented by Spiegel.
Curvilinear orthogonal coordinates; cylindrical and spherical coordinate systems; gradients, divergences and curls in curvilinear coordinates and their geometrical interpretation, with examples from physical systems; Gauss's and Stoke's theorems. Laplacian and wave operators.

Dirac Delta Functions (~4 lectures)
Properties of the delta function; delta function of a function; delta functions in more than one dimension. [Susan Lea, *Mathematics for Physicists* (Thomson 2004) Chapter 6 has more details on this topic]