

Spring 2018

UNIVERSITY OF MARYLAND, College Park
Physics 274: Mathematical Methods for Physics I

Prof. B L Hu

Description: This course is the first of a two semester sequence (274-373) in mathematical methods for physics intended for physics majors and those desiring a rigorous preparation in the physical sciences. Topics include curvilinear coordinates and vector analysis, linear algebra and Dirac functions.

Prerequisites: PHYS272 and MATH241.

Office of Undergraduate Studies Course Policies for Undergraduates <http://www.ugst.umd.edu/courserelatedpolicies.html>

Lectures: MWF 2:00pm - 2:50pm, in Symons Hall room 0200

Lecturer: Prof. B. L. Hu, Office: PSC3153, Phone: (301) 405-6029, Email: blhu@umd.edu Mailbox #425 Mailroom is in Toll Bldg. Please note: Do not leave any material (e.g., your late homework) in my office. Office hours: MW1-2pm (may change, for seminars). Please email me ahead of time if you intend to come. TA: Mark Zic Office: @, Phone: (240) 813-5170 Email: markzic@terpmail.umd.edu Mail Box #423

Textbooks: Mary L. Boas, *Mathematical Methods in the Physical Sciences*, 3rd ed (Wiley) (required)

Errata: [Corrections and Minor Revisions of Mathematical Methods in the ...](#)

R. Snieder and K. van Wijk, *A Guided Tour of Mathematical Methods for the Physical Sciences* 3rd ed (Cambridge University Press 2015) (required)

Spiegel, Lipschutz and Spellman, *Vector Analysis* 2nd ed Schaum's Outlines (recommended for practice)

Reading: The main subjects and the approximate progression of topics can be found 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, you should *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 be able to grasp fully on the 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*. It makes a real difference in your grasp of the subject matter which shows 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. See University policy below for consequences. This includes also partial consultation of solutions. 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 these problem(s) till you get it right*. Make this a habit. Homework is essential to your mastering a subject.

Mid-Term Exams: Two 50-minute closed book mid-term exams are scheduled on **Friday March 9 and Friday April 13 during the lecture periods**. They are likely to contain one or more problems based on the assigned homework problems. Each exam counts 100 points towards your course grade. **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 **Wednesday May 16, 1:30-3:30pm** is worth 240 points of the total course score grade. 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 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 midterm exams. Add 1 new card for a total of 3 cards for the final exam. Only formulas, no derivations. The values of constants and useful integrals will be provided. Only a non-programmable calculator with standard trigonometry function is allowed, no smart phones, I-Pads etc.

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	<u>160</u> points
2 Midterm Exams	<u>200</u> points
1 Final Exam	<u>240</u> points
Total Course Score:	<u>600</u> 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 with- out 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 pro- mote 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:

Curvilinear Coordinates and Vector Analysis (~ 4 weeks)

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.

Linear Algebra (~ 8-9 weeks)

Linear vector spaces; linear operators and their representation as matrices; matrix algebra; determinants and their application to the solution of linear inhomogeneous equations; inner products; eigenvalues and eigenfunctions with examples of applications to physical problems; infinite dimensional vector spaces.

Dirac Delta Functions (~3-4 lectures)

Properties of the delta function; delta function of a function; delta functions in more than one dimension.