

Phys 700: Mathematical Physics I

Text: *Mathematical Methods for Physicists* 6th Ed. (ISBN: 0-12-059876-0), by Arfken & Weber (Elsevier publishers 2005)

Content: We will be covering various mathematical topics that are of great importance to physicists. Such topics include vector analysis, tensors, matrices and determinants, group theory, complex variables (including contour integration), differential equations, and special functions. The amount of detail will be adjusted according to the interest of the class.

Expectations: It is expected in the very least that you will be able to solve basic problems related to the material covered and understand the fundamental concepts associated with this material to pass the course.

Learning Outcomes:

1. Develop a deep sense of connection between mathematics, physics, and the ability to solve real problems in physics via mathematics.
2. To be cognizant of and proficient in using advanced mathematical methods to solve various problems in electromagnetism, quantum mechanics, thermal/statistical physics, optics, particle physics, and nuclear physics by, e.g. understanding how to solve partial differential equations, solving ordinary differential equations using advanced series solutions, matrix mechanics (including the use and manipulation of tensors), the use of complex variables to solve complex integrals and as a means to reduce the complexity of problems.
3. To be aware of the critical importance of boundary conditions to “force the physics” and how to use them.
4. To be able to extract real numbers/solutions using the above methods to connect with reality/the natural world.

Grading:

30% Homework

20% Quizzes

25% Midterm Exam

25% All Inclusive Final Exam)

Grading Scale:

90 → 100: A- → A+; 80 → 89: B- → B+; 70 → 79: C- → C+; 60 → 69: D- → D+; Below 60: F

DO NOT AUTOMATICALLY EXPECT A CURVE!

ATTENDANCE FOR THE FINAL EXAM AT THE SCHEDULED TIME IS REQUIRED.

Attendance: You are expected to attend all lectures. You are responsible for all assignments and announcements given in class. Missed exams and quizzes will result in a grade of zero. In the event of an extreme emergency (e.g. hospitalization), make-up exams and quizzes may be given only with the written permission of the Chair of the Physics Department or the Dean of Arts and Sciences. You may be asked to provide written documentation to justify your request to make up material. For example, often an excuse such as “I had a death in the family” is given for an absence. If such is the case, then proof of death and proof of close family relation must be supplied in order for the work to be made up. If you represent UNLV at any official extracurricular activity, you shall have the opportunity to make up assignments, but you must provide official written notification to the instructor no less than one week prior to the missed class. A student missing a class or laboratory assignment because of observance of a religious holiday shall have the opportunity to make up missed work. The student must notify the instructor of anticipated absences by the last day of late registration. Students who represent UNLV at any official extracurricular activity shall have the opportunity to make up lost work but must provide written notification to the instructor no less than one week prior to the missed class(es).

Homework: Homework will be assigned weekly and due one week later. Physics cannot be mastered without working out physics problems. Don't be discouraged when the material initially seems unfamiliar or the homeworks are difficult. You are not expected to understand the material immediately. Your mastery of physics will be a gradual process that will develop through diligent practice (i.e., homework). Hopefully, you will learn that this is not an unpleasant but intellectually engaging experience. Although each homework assignment is numerically worth the least in terms of your overall grade, it is the most important part of your studies. Although we will discuss homework problems occasionally in lecture, questions on homework can always be raised with your instructor during his office hours.

Exams: The Final Exam will encompass ALL of the material covered in the class.

Cheating: Any person caught cheating on an exam will be dropped from the course. You are permitted, and even encouraged, to work together discussing homework assignments however, you are required to write up your homework alone. Blatant copying on homework will be punished with a grade of zero for the work in question and may result in further disciplinary action.

Academic Misconduct: Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

Copyright: The University requires all members of the University Community to familiarize themselves **with** and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/provost/copyright>.

Disability Resource Center (DRC): The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Religious Holidays Policy: Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

Transparency in Learning and Teaching: The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning>

<https://www.unlv.edu/provost/transparency>

Incomplete Grades: The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring and Coaching: The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895- 3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

UNLV Writing Center: One-on- one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

Rebelmail: By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always **@unlv.nevada.edu**. **Emailing within WebCampus is acceptable.**

Library Resources: Students may consult with a librarian on research needs. For this class, the subject librarian is https://www.library.unlv.edu/contact/librarians_by_subject. UNLV Libraries provides resources to support students' access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at <https://www.library.unlv.edu/>.

Final Examinations: The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

Final Note: You will find that the knowledge and problem solving skills that you learn here will be extremely valuable no matter what career path you follow. Therefore try hard, and **never** be afraid to ask questions. ***This syllabus may change as the course progresses. The instructor will provide advance notice if and when this happens.***

Tentative Schedule:

Week 1 (1/20, 1/22)	Chapter 1	Vector analysis
Week 2 (1/27, 1/29)	Chapter 2	Vector analysis in curved coordinates and tensors
Week 3 (2/3, 2/5)	Chapter 3	Determinants and matrices
Week 4 (2/10, 2/12)	Chapter 3	Determinants and matrices
Week 5 (2/17, 2/19)	Chapter 4	Group Theory
Week 6 (2/24, 2/26)	Chapter 5	Infinite Series
Week 7 (3/3, 3/5)	Chapter 6	Functions of a Complex Variable I
Week 8 (3/10, 3/12)	Chapter 7	Functions of a Complex Variable II and Midterm
Week 9 (3/17, 3/19)	Chapter 8	The Gamma Function
Week 10 (3/24, 3/26)	Chapter 9	Differential equations

Week 11 (3/31, 4/2)	Spring Break	
Week 12 (4/7, 4/9)	Chapter 10	Sturm-Liouville theory - orthogonal functions
Week 13 (4/14, 4/16)	Chapter 11	Bessel functions
Week 14 (4/21, 4/23)	Chapters 12	Legendre functions
Week 15 (4/27, 4/30)	Chapters 13	More special functions
FINAL EXAM:	Tuesday, May 12 from 1:00pm – 3:00pm.	

SAMPLE