

PHYSICS 5309-001 - **Electromagnetic Theory I**

Instructor: Prof. N. G. Fazleev

Days: TuTh Spring 2013

Time: 3:30 pm– 4:50 p.m. Room: 109 Geoscience

Course Prerequisites: *Permission of Graduate Advisor*

Required Textbook:

Classical Electrodynamics, John David Jackson (Third Edition), John Wiley & Sons, 1999.

Recommended Books:

Introduction to Electrodynamics (2nd Edition), D. J. Griffiths, Prentice Hall, 1989.

Classical Electromagnetism in a Nutshell, Anupam Garg, Princeton University Press, 2012

Classical Electrodynamics (2nd Edition), H. C. Ohanian, Infinity Science Press, 2006.

Electrodynamics of Continuous Media, L. D. Landau, E. M. Lifschitz, and L. P. Pitaevskii, Butterworth-Heinemann, 1995.

The Classical Theory of Fields, L. D. Landau and E. M. Lifschitz, Butterworth-Heinemann, 2000.

Mathematical Methods for Physicists, (Sixth Edition), G. B. Arfken and H. J. Weber, Elsevier Academic Press, 2005

Course Description: This is the first semester of a two-semester course on classical electricity and magnetism, electromagnetic waves, special relativity, and electromagnetic radiation. The specific content of the course will mainly be drawn from the classic text by Jackson. We will study the following topics:

(a) Electrostatics, (b) Boundary Value Problems in Electrostatics, (c) Multipoles, Electrostatics of Macroscopic Media, Dielectrics, (d) Magnetostatics, (e) Boundary Value Problems in Magnetostatics, (f) Faraday's Law, Quasi-Static Fields, (g) Maxwell's Equations, Macroscopic Electromagnetism, (h) Plane Electromagnetic Waves and Wave Propagation.

Course Learning Goals/Objectives: The main goal of the course is to present an in-depth account of classical electrodynamics, emphasizing the unity of electric and magnetic phenomena as well as their physical foundations. Problem solving is stressed as a means of imparting physical understanding and intuition.

Outline of the Course Content:

Introduction to Electrostatics

Coulomb's Law, Gauss's Law, Poisson and Laplace Equations, Green's Theorem, solutions using the Green function.

Boundary-Value Problems in Electrostatics

Method of images, Green function for the sphere, orthogonal functions and expansions, separation of variables, Laplace equation in rectangular, spherical and cylindrical coordinates, addition

theorem for spherical harmonics, expansion of Green functions in spherical coordinates, cylindrical coordinates, and in terms of eigenfunctions.

Multipoles, Electrostatics of Macroscopic Media, Dielectrics

Multipole expansion, boundary-value problems and dielectrics, molecular polarizability and electric susceptibility, electrostatic energy in dielectric media.

Magnetostatics

Biot and Savart law, the differential equations of magnetostatics and Ampere's law, the vector potential, magnetic moment, force, torque, macroscopic equations, methods for solving boundary-value problems in magnetostatics.

Time-Varying Fields, Maxwell Equations, Conservation Laws

Faraday's law, Maxwell's displacement current, Maxwell's Equations, vector and scalar potential, gauge transformations, Poynting's theorem, transformations of electromagnetic fields and source, conservation laws, magnetic monopoles.

Plane Electromagnetic Waves and Wave Propagation

Plane waves, linear and circular polarization, reflection and refraction of electromagnetic waves, polarization by reflection, total internal reflection, waves in a conducting or dissipative medium, spreading pulses, dispersion relations.

Homework:

You are required to read and study chapters 1 - 7 in Jackson. You are encouraged to attempt all of the problems in chapters 1 - 7 of Jackson. You are also encouraged to read selected sections of the supplementary material (such as may be pointed out in class on various occasions). Problem sets will be assigned (usually one a week). Problem sets will be collected one week after they have been assigned.

Grading :

There will be two regular exams, a final exam, and problems which are collected and graded. Regular exams and the average for problems will count equal weights and the final will count double weight. Partial credit will be given on exams. No scores will be dropped. **Make up tests will be allowed only if prior notification of an excused absence is given.** Letter grades will be assigned to a curve, but scores in the ranges below assure a minimum grade shown:

A	90 – 100
B	80 – 90
C	70 – 80
D	60 – 70
F	00 – 60
X	Arrangement at the end of semester
P	Arrangement at the beginning of semester

Americans with Disabilities Act

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112 -- The Rehabilitation Act of 1973 as amended.

With the passage of new federal legislation entitled Americans With Disabilities Act - (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide **"reasonable accommodation"** to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with **informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.**

Academic Dishonesty

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

"Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)

Student Support Services Available

The University of Texas at Arlington supports a variety of student success programs to help you connect with the University and achieve academic success. These programs include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

Grade replacement:

If you are retaking this course in order to replace a previous grade, you must complete the necessary form by census day. The forms required are located at the Bursar's Office in Davis Hall. If you do not complete the forms by census day, the University will not honor the replacement.

Drop for non-payment of tuition:

If you are dropped from this class for non-payment of tuition, you may secure an Enrollment Loan through the Bursar's Office. You may not continue to attend class until your Enrollment Loan has been applied to outstanding tuition fees.

Other drops:

Students wishing to drop this class or resign from the university during the semester must do it themselves, but should consult the instructor in advance to determine the course grade to be reported.

Office Hours:

Chemistry and Physics Building, Room 336
2:00 -3:00 p.m. TuTh or by appointment.

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