**PHYSICS 5313-001 - Electromagnetic Theory II**

**Instructor: Prof. N. G. Fazleev**

**Days: MoWeFr Fall 2010**

**Time: 10:00 a.m.– 10:50 a.m. Room: 105 Science Hall**

**Course Prerequisite**: PHYS 5309, Electromagnetic Theory I

**Required Textbook:**

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

**Recommended Books:**

*D. J. Griffiths, Introduction to Electrodynamics, 3rd edition, Prentice Hall, 1998.*

*L. D. Landau and E. M. Lifshitz, The Classical Theory of Fields, 4rd edition, Butterworth-Heinemann, 1987.*

*L. D. Landau, E. M. Lifshitz, and L. P. Pitaevskii, Electrodynamics of Continuous Media, 2nd edition, Pergamon Press, 1984.*

*H. C. Ohanian, Classical Electrodynamics, 2nd edition, Infinity Science Press, 2006.*

*J. R. Reitz, F. J. Milford, and R. W. Christy, Foundations of Electromagnetic Theory, 4th edition, Addison-Wesley, 2008.*

*G.B. Arfken & H.J. Weber, Mathematical Methods for Physicists, Elsevier Academic Press 2005, 6th edition.*

**Course Description:** This is the second semester of a two-semester course on classical classical electrodynamics. The course will provide a vigorous mathematical treatment of electricity, magnetism, and related phenomena. Covered topics include the Maxwell equations and their applications, electromagnetic waves, radiation, scattering and special theory of relativity. The specific content of the course will mainly be drawn from the classic text by Jackson.

**Course Learning Goals/Objectives:** The main goal of the course is to present in-depth an 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.

## Course Outline

**1. Time-Dependent Potentials and Fields**

Maxwell equations for time-dependent fields; wave equations; gauge transformations; Green function for the wave equation; retarded and advanced potentials; Jefimenko equations; conservation laws.

**2. Electromagnetic Waves**

Plane E&M waves; polarization; propagation in linear media; reflection and refraction; frequency dispersion; superposition of waves; phase and group velocities; Kramers-Kronig relations; waveguides and transmission lines.

**3. Radiation of Electromagnetic Waves**

Localized radiating systems; electric dipole, magnetic dipole, and electric quadrupole fields; multipole expansion; angular distribution of radiation; linear antenna.

**4. Scattering and Diffraction**

Perturbation theory of scattering; long and short wavelength limits; scalar diffraction theory; Babinet's principle; Fresnel and Fraunhofer diffraction; optical theorem.

**5. Special Theory of Relativity**

Einstein's postulates; Minkowski space-time; Lorentz transformation; 4-vectors; intervals; covariant and contravariant tensors; relativistic formulation of E&M theory; field-strength tensor; transformation of E&M fields.

**6. Particles in Electromagnetic Fields**

Dynamics of relativistic particles in external E&M fields; particle drift; Lagrangian for the E&M field; interaction of charged particles; collisions; elastic and inelastic scattering; Cherenkov radiation; radiation by an accelerated charge; radiative damping.

## Homework

You are required to read and study chapters 7 - 16 in Jackson. You are 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 on a regular basis. Normally, problem sets will be due 7−10 days after the assignment date.

## Grading

There will be two regular exams, a final exam, and problems which are collected and graded. The regular exam 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. **The make up test 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:

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|---|---|
| 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**
**3:00 p.m. - 4:00 p.m. MoWe or by appointment**.

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