Course Syllabus

Electricity and Magnetism II

PHY 4324 co-listed as PHY 5327

P. Schlottmann, Spring 2017

Course Description

This is the second semester of a two-semester undergraduate level sequence on the concepts, mathematical methods and applications of Electricity and Magnetism. While in Classical Mechanics the focus is on Newton's laws and Quantum Mechanics is all about the Schrödinger's equation, the basis for Electrodynamics are Maxwell's equations. They consist of four first order vector differential equations for the electric and magnetic fields. The emphasis is on waves and not so much on particles. Vector calculus is the most important tool to solve any problem in this course. A solid background in curvilinear coordinates, gradient, curl and divergence, as well as line, surface and volume integrals of vector quantities is absolutely necessary. The emphasis of the course is on problem solving. During the first semester we covered most of the aspects of Electrostatics and Magnetostatics. In the second semester we study Electrodynamics, i.e. charges in motion, electromagnetic waves and relativity.

The course is aimed mainly at physics majors, for whom E&M is the third set of advanced undergraduate courses. Although most of the concepts covered in E&M were previously introduced in General Physics B (PHY 2049), the math level used here is considerably higher. A thorough mastery of mathematical skills is essential for problem solving. The first chapter of the textbook presents a summary of what knowledge in Vector Analysis is expected or needed. We will start with chapter 7 and refer to the mathematical results of chapter 1 whenever needed. The lecture will closely follow the textbook.

Prerequisites: Calculus III (MAC 2313) and Electricity and Magnetism I (PHY4323/5326).

Brief Outline

VI. Electrodynamics: Ohm's law, Faraday's law and Maxwell's equations
VII. Conservation Laws: Charge, energy and momentum
VIII. Electromagnetic Waves, Wave Guides
IX. Potentials and Fields: Gauge transformations and retarded potentials

X. Radiation: Electric and magnetic dipole radiation; radiation by a point charge
XI. Relativity: Special theory of relativity, relativistic mechanics, and relativistic electrodynamics

Students registered in PHY5326 will get additional reading assignments.

Recommended Text

The instructor will closely follow the recommended textbook. Any other Electrodynamics textbook is also useful. Actually reading a textbook is strongly recommended.

David J. Griffiths, *Introduction to Electrodynamics,* Fourth Edition (2013), Pearson Education, Inc., Boston, MA.

Griffiths is a standard undergraduate textbook for Electrodynamics, which is widely used. Most of the homework problems are taken from this book. The book contains all the information you need to know, mostly in the same order as the material covered in the lecture. This book can be bought at the FSU-bookstore.

Reference Books

- W. Greiner, Classical Electrodynamics, Springer, New York (1998).
- J. D. Jackson, Classical Electrodynamics, John Wiley & Sons, Inc., New York (1962).
- L. D. Landau and E. M. Lifshitz, The Classical Theory of Fields, 4th edition, Pergamon Press, Oxford (1976).

Learning objectives

- After
  - attending the lectures
  - studying the textbook and other assigned materials, and
  - solving the assigned homework problems
- The Student should be able to, in an exam situation,
  - analyze electrodynamics problems within the areas of the above-mentioned topics
  - identify the relevant concepts
  - decide on a solution strategy
  - choose the appropriate mathematical techniques
  - formulate the problem on paper, including necessary sketches
  - perform the necessary calculations
  - explain the steps
  - obtain the required solution
  - interpret the results, and
  - judge the likelihood that the obtained solution is correct

Student Responsibilities

The responsibilities as a student include

- being prepared ahead for lectures by surveying the material to be covered
- attending lectures while
  - ☐ taking notes
  - ☐ attempting to answer questions from the instructor
  - ☐ asking questions if something is unclear
- reviewing the notes taken after the lecture
- turning in all assigned homework on time
- picking up corrected homework when it is returned
- taking advantage of learning opportunities such as office hours
- taking all tests and exams

Evaluation of Performance

The course grade will be based on the homework assignments, two 75 minutes tests (mid-term exams) and the final exam. There will be *eleven* homework sets of *five* problems each. Every student should attempt to **solve all problems**. The solution of the problems is to be turned in at a given deadline. The instructor's solution of all of the problems will be posted on the course web-page (http://web2.physics.fsu.edu/~phy4324) shortly after. Discussions of the problems among students are strongly encouraged, but each student should write out and turn in his/her own solutions. The "mid-term exams" and the final exam will be based (although not exclusively) on material covered in class and the homework problems. Hence, it is important to solve all the homework problems.

The five homework problems of each set will be graded on the scale from 0 to 2 points. The solutions are going to be checked for completeness and a solution that is essentially correct will get 2 points, while an incomplete solution with incorrect answers will receive 0 points. I hope this arrangement works out, otherwise I will have to change the grading procedures. The homework will be accepted and graded only if written in a neat and orderly fashion, and if the answers are justified by showing the complete work. It is important that everybody attempts the problems before asking a colleague or the instructor how to do it. Identical copies of the same homework will not be accepted. The homework performance contributes with 25%, each of the "mid-term exams" with 25%, and the final exam with 25% to the course grade.

The homework performance will be computed based on the ten best homework scores, i.e. the lowest score will be dropped. A homework not handed in on time may count as a drop, independently of the reason or any acceptable excuse.

Make-up tests for missed exams will be given only in case of an acceptable excuse. Acceptance of any excuse is at the instructor's discretion.

Class attendance will count as a 5% bonus, i.e. above and beyond the 100% of homework and exams. During five classes in the semester the instructor will take attendance without previous notification. Each time 1% extra credit is given to those present. No excuses for absence will be considered. The purpose is to encourage class attendance.

The grade dividing lines are subject to adjustments at the end of the course. Tentatively the required score for A and A- is at least 90%, the dividing line between B- and C+ is 70%, the C range is between 50% and 70%, scores between 40% and 50% correspond to D and below 40% the grade will be F.

ADA Statement

Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center (SDRC), and (2) bring a letter to the instructor from SDRC indicating your need for academic accommodation and what type. Please do this during the first week of class. For more information about services available to FSU students with disabilities, contact

Student Disability Resource Center
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
E-mail: sdrc@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "... be honest and truthful and ... [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://dof.fsu.edu/honorpolicy.htm.). Students are expected to uphold this Academic Honor Policy.

University Attendance Policy

Excused absences include documented illness, deaths in the immediate family and other documented

crisis, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.