

**University of Puerto
Rico Río Piedras
Campus
Faculty of Natural Sciences, Department of
Physics Undergraduate Programme**

Course Electromagnetism II

Code PHYS 4069

Number of Credits 3

Prerequisites MATH 3152, PHYS 3171-3172, PHYS 4068

Instructor Lutful Bari Bhuiyan

Office Natural Sciences II, C-350

Class period: Mondays and Wednesdays, 1:00-2:40 PM, Room C-312

Office hours: Tuesdays and Thursdays, 8 am – 1 pm, 2 pm – 3.30 pm

Fridays 8 am – 12 noon, 2 pm – 3.30 pm

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Description

This is the second part of the one year course in Electromagnetism for Physics majors, which covers electrostatics, magnetostatics and electrodynamics: Electromagnetic induction, Maxwell equations, Conservation Laws, Electromagnetic waves in one dimension in vacuum and matter, Potential and radiation

Objectives

After completing this course the student

- Will learn the basic concepts and techniques of classical electrodynamics
- will be able to apply the Maxwell equations in different physical situations and setup the corresponding mathematical problem.

Course Contents

- **Week 1** Basic concepts. Brief resume of electrostatics, Maxwell's modification of Ampere's law, Maxwell's laws in vacuum, Maxwell's laws in a material medium, Integral form of Maxwell's laws.
- **Week 2-3** Conservation laws, Continuity equation, Poynting's theorem
- **Week 4-5** The wave equation and the basic concepts of wave propagation in one dimension, electromagnetic wave propagation in vacuum and the wave equation for **E** and **B**.
- **Week 6-7** Monochromatic plane wave --- energy and momentum in electromagnetic waves
- **Week 8-10** Electromagnetic wave propagation in a linear (material) medium, reflection and refraction (transmission) at (a) normal incidence, (b) oblique incidence
- **Week 11-12** Electromagnetic waves in a conducting medium, dispersion and the frequency dependence of permittivity.

- **Week 13-15** Guided waves, rectangular wave guides, Potential and radiation

Instructional Strategy

The main instructional tool in this class is lecturing. The students are trained to apply the Maxwell equations to simple physical situations and setting up the problem mathematically, which is then solved using standard mathematical methods. A fair part of the lecturing effort is thus dedicated to the demonstration of solution of problems of electromagnetism.

Student Evaluation

The grading is based on four exams, each of which has a weight of 25% of the final grade.

Exam 1. Will include the materials covered in Weeks 1-3.

Exam 2. Will include materials covered in Weeks 4-7

Exam 3. Will include materials covered in Weeks 8-10

Exam 4. Will include materials covered in Weeks 11-15.

The exams will be based on examples done in class, suggested problems, and exercises given throughout the course. The dates of the partial exams will be agreed to in classes.

Grading system

The student completing the course work will be graded according to the standard scale A to F.

Text *Introduction to Electrodynamics*, David J. Griffiths, Third Edition, Prentice Hall 1999, ISBN 0-13-805326-X.

Bibliography Classic reference *Foundations of Electromagnetic Theory*, John R. Reitz, Frederick J. Milford, and Robert W. Christy, 4th Edition, Addison Wesley 2008, ISBN-13-978-0321581747

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La Universidad de Puerto Rico promueve los más altos estándares de Integridad académica y científica. El Artículo 6.2 del Reglamento General de estudiantes de la UPR (Certificación Núm. 13, 2009-2010, de la Junta de Síndicos) establece que “la deshonestidad académica incluye, pero no se limita a: acciones fraudulentas, la obtención de notas o grados académicos vallándose de falsas o fraudulentas simulaciones, copiar total o parcialmente la labor académica de otra persona, plagiar total o parcialmente el trabajo de otra persona copiar total o parcialmente las respuestas de otra persona o las preguntas de un examen, haciendo o consiguiendo que otra tome en su nombre cualquier prueba o examen oral o escrito, así como la ayuda o facilitación para que otra persona incurra en la referida conducta” . Cualquiera de estas acciones estará sujeta a sanciones disciplinarias en conformidad con el procedimiento disciplinario establecido en el Reglamento general de Estudiantes de la UPR vigente.