

## ELECTRICITY AND MAGNETISM II

### SYLLABUS *Physics 213* Spring 2022

This is the “*electrodynamics*” part of the two-part E&M series. The first part of the series was primarily concerned with static charges and steady-state currents, and the static fields and potentials they create. When discussing magneto-statics you also considered time-dependent currents, since these revealed the very important relationship that exists between electric and magnetic fields. In the second part of the series, we will be concerned initially with the fields themselves, particularly time-dependent currents, potentials and fields, and their manifestations in the form of electromagnetic waves. This will allow us to lay out the foundations for geometrical and physical optics. We will then examine the origin of these waves, i.e. how moving charges and changing currents produce electromagnetic waves (radiation). Finally, the last part of the course will examine special relativity, which is an essential aspect of a complete theory of electrodynamics, because of the reciprocal relationship between changing magnetic fields and changing electric fields.

Therefore, this second half of the E&M course is in **three parts**:

#### A- ELECTRODYNAMICS

Maxwell's Equations

Conservation Laws (Energy and Momentum)

Electromagnetic Waves

#### B- RADIATION

Moving charges and changing currents

Time-dependent fields and potentials

Emission of Radiation

#### C- SPECIAL RELATIVITY

#### BOOK

D.J. Griffiths Introduction to Electrodynamics 4<sup>th</sup> edition, Prentice Hall (1999)

You may also consult R.K.Wangsness, Electromagnetic Fields 2<sup>nd</sup> edition, John Wiley (1986)

#### GRADING

Homework 20%

Midterm 25%

3 Quizzes 20%

Final 35%

#### FINAL COMPETENCIES

The students should

- be able to describe the nature and the characteristic properties of electric and magnetic fields, and the mutual interrelationship between these fields
- be able describe the effect of these fields on electric charges and magnetic dipoles
- understand how moving charges and changing currents give rise to electromagnetic radiation and be able to describe the nature and properties of electromagnetic waves
- understand the origin of relativity, be able to give examples of its manifestation and understand the relationship it establishes between electric and magnetic fields in different frames of reference

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Please note that class attendance is mandatory (so that we are all on the same page throughout the semester)

ALSO: The use of cell phones in class will be prohibited

**Accommodations for Students with Disabilities: Accommodations for Students with Disabilities:** If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, Williams Hall, Suite 301 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.