



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Fisica II

2223-3-E3501Q069

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#### Aims

Maxwell Equations, Special Relativity.

Expected learning targets:

- knowing how to solve simple problems in electrostatics, magnetostatics, magnetic induction, RLC circuits;
- knowledge of Maxwell equations, their conceptual base and derivation, relationships among them; knowledge of the basics of special relativity, and of its relationship with electromagnetism.

#### Contents

Electrostatics: Coulomb's law, Gauss' Law. Electric currents: Ohm's law.

Special relativity. Magnetostatics: Biot-Savart equation, Ampere's Law.

Magnetic induction; Faraday's law. LRC circuits.

Maxwell's equations. Electromagnetic waves. Poynting vector. Relativistically covariant notation for electromagnetism.

#### Detailed program

- Electrostatics. Coulomb's law; electric field, electric potential. Gauss' Law. Poisson's equation; Laplacian. Energy of the electric field. Curl of the electric field. Harmonic functions. Conductors. Capacitors. Exterior calculus.
- Moving charges. Electric current; Ohm's law. RC circuits.
- Special relativity. Lorentz transformations; four-vector notation.
- Magnetostatics. Deduction of the existence of magnetic field; its divergence and curl. Vector potential.
- Magnetic induction. Circuits moving in a magnetic field; Faraday's law. Inductance. Energy of the magnetic field. LRC circuits. Applications: power lines, radio.
- Maxwell's equations. Time-dependent currents. Electromagnetic waves. Poynting vector. Relativistically covariant notation for the electromagnetic field and for Maxwell's equations. Exterior calculus in spacetime.

## Prerequisites

Physics I, Analysis I & II

## Teaching form

Lectures (6 CFU); Exercise sessions (2 CFU)

## Textbook and teaching resource

Lecture notes available at  
<https://www.dropbox.com/s/s2kvegmy9t0xc5t/EM.pdf?dl=0>

D. J. Griffiths, Introduction to electrodynamics. Prentice Hall, 1999.

E. M. Purcell and D. J. Morin, Electricity and magnetism. Cambridge University Press, 2013.

## Semester

first semester.

## Assessment method

Written and oral exam, of equal weight in the final evaluation, not necessarily in the same call.

Written exam: four exercises, three hours. Admission to the oral exam with 14/30. Object of evaluation will be the logic used in the resolution of the problems. Possibility to hold the written exam in two partial sessions.

Oral exam: open questions on the course's topics, unrelated to the written exam. Object of evaluation will be the

candidate's knowledge of the theoretical part of the program.

### **Office hours**

by appointment.

### **Sustainable Development Goals**

QUALITY EDUCATION

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