UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics II

2425-3-E3501Q069

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, Analysis II.

Teaching form

24 lectures, 2 hours each, delivered didactics, in presence (6 CFU).
12 exercise sessions, 2 hours each, delivered didactics, in presence (2 CFU).
In Italian.

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 exam. Four exercises, three hours.
It is possible to hold the written exam in two partial sessions. Each of them will consist of three exercises, in two hours.
Both for the normal written exam and for the partial sessions, object of evaluation will mostly be the logic used in

the resolution of the problems.
It is possible to hold the exam in English.

Office hours

by appointment.

Sustainable Development Goals

QUALITY EDUCATION