



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics II

2425-2-E3002Q009

Aims

The course Fisica II is aimed at providing the students with the basic knowledge of classical electromagnetic theory, from the electric and magnetic fields, to time-dependent fields and electromagnetic waves.

Contents

ELECTRIC FIELD

MAGNETIC FIELD

ELECTROMAGNETIC INDUCTION

MAXWELL EQUATIONS

Detailed program

ELECTRIC FIELD

Electric charge; Coulomb law; electric field and its properties; electric field calculation by the Coulomb law; force lines of the electric field; Gauss law; electric field calculation by the Gauss law; electrostatic properties of a conductor; potential energy in the electric field; electric potential; voltage; relation between electric field and voltage; capacity and capacitors; series and parallel configurations of capacitors; electrostatic energy; electrical current and resistance; Ohm law; series and parallel configurations of resistors; electromotive force; electric energy and power; capacitor charge and discharge.

MAGNETIC FIELD

Lorentz force; force on a conductor with electric current; torque acting on a coil; Biot-Savart law; magnetic field calculation by the Biot-Savart law; Ampère law; magnetic field calculation by the Ampère law; magnetic field in a coil; force acting between conductors with electric currents; Gauss law for magnetic fields; displacement current and the Ampère-Maxwell law.

Faraday Neumann law and Lenz principle; induced electromotive force; power supplies; induced electric field; self-induction; energy in RL circuits; mutual induction.

Maxwell equations in vacuum. Magnetic properties of the matter; magnetic moments and magnetization. Maxwell equations in the matter.

ELECTROMAGNETIC WAVES

Armonic waves and wave equation; plane waves; relation between electric field and magnetic field in plane waves; wave equation for electric field and magnetic field; electromagnetic field; energy carried by electromagnetic waves and Poynting vector. Oscillating dipoles as source of electromagnetic waves; electromagnetic spectrum. Interference; wave packets.

Prerequisites

Basic knowledge from the courses of Mathematics I and II and Physics I.

Teaching form

Lessons and exercises in Italian.

Textbook and teaching resource

A university textbook about Classical electromagnetism can be the proper choice; a textbook with the right level for this Course is:

P. Mazzoldi, M. Nigro, C. Voci, **Elementi di Fisica, elettromagnetismo e onde** (Edises Università).

All the lessons are recorded and published in the elearning platform, open to all students for about 10 days, as a support to the students who missed the lessons or need to review their notes.

Semester

II year, I and II semester.

Assessment method

Written exam with exercises similar as those discussed during the year; four possible levels: A, B, C, D. For the

students reaching at least level C, **oral exam**. The written exam is only aimed at selecting the students for the oral exam.

The **oral exam** consists in the discussion of the fundamental subjects of classical electromagnetism, presented and explained during the classes.

The final mark considers the oral exam.

Office hours

Upon request, via e-mail: adele.sassella@unimib.it

Sustainable Development Goals

QUALITY EDUCATION
