UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics II

2021-2-E2701Q060

Aims

The course gives the fundamentals of electromagnetism and optics as a tool for the understanding of the interactions between materials and electromagnetic fields, including light.

Contents

The course starts from the description of the interactions between charged systems and introduces the concepts of electric field, flux of electric field, electrostatic energy and potential, giving the formal elements for both an integral and differential description. The course gives then the basis for the description of charging processes in conductors and polarization effects in dielectrics with the fundamental quantities describing charge transport in the electric conduction processes. The analysis of moving charges brings to the introduction of the concept of magnetic field and the interaction between magnetic fields and moving charges, including charged systems with magnetic dipole moment. The course then analyses the electric and magnetic contributions arising from time dependent fields, finally giving the general framework of Maxwell equations in their integral and differential forms. From these equations, the wave equations for the electric and magnetic components of the electromagnetic radiation are obtained, with also the basis for the general analysis of optical signals as overlapping monochromatic components. Finally, the course gives a short analysis of the formal tools for the description of both geometrical optics and electromagnetic wave propagation.

Detailed program

Prerequisites

Basic knowledge of Mathematical analysis and Newtonian physics.

Teaching form

The course comprises lectures including practical exercises and summary lessons on the main three lecture blocks on i) electrostatic, ii) electric currents and magnetism, and iii) time dependent effects and optics, respectively.

During Covid-19 emergency, class will be online in livestreaming via WebEx meeting from links on the e-learning page of the course. On the same e-learning page, all the lectures will be available as recorded video files.

Textbook and teaching resource

Reference textbook:

Elementi di fisica, Elettromagnetismo e onde – P. Mazzoldi, M. Nigro, C. Voci – EdiSES 2008

Additional resources:

Exercises with resolution on the e-learning platform.

Semester

First semester

Assessment method

Students must first demonstrate in a written test – usually composed by three or four exercises – to possess the formal tools for the description and quantification of situations in which charged systems and/or moving charges interact with each other and with either static or time dependent electromagnetic fields, and for the description of electromagnetic waves and simple optical systems. Test evaluation is communicated in few days before a second test consisting in an interview aimed at evaluating the acquired knowledge on the full program, specifically verifying the consciousness of the physical meaning of electromagnetic quantities and relationships.

During Covid-19 emergency, exams will be only oral online exams. Online exams will be taken via WebEx. The link to the WebEx exam event will be available on the e-learning online system, also for virtual attendees. The oral exam will however include at least a practical exercise to be solved quantitatively.

Office hours

11:00-13:00 Monday, Thursday, Friday

14:00-17:00 Thursday