UCLouvain

lphy1112

2017

General Physics 2

8 credits	45.0 h + 45.0 h	Q2

Teacher(s)	Govaerts Jan ;Lemaitre Vincent ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	Electrostatics. Electric potential and field. Magnetism. Electric circuits
Aims	**a. Course contribution to the LO reference framework (programme LO)** **LO1:** 1.1, 1.3, 1.4 **LO2:** 2.1, 2.2, 2.4 **LO3:** 3.1, 3.2, 3.3, 3.6 **b. Specific formulation of programme LOs for this course** At the end of this course, the student will be able: 1 1. To formulate the physical laws of electromagnetism on the basis of experiment observations. 2. To understand the synergies and connections amongst the charge-current, field E-field B potential groups. 3. To understand the relative nature of certain fundamental concepts such as fields E and B. 4. To appreciate the power of a reductionist approach in relation to a fundamental understanding of electromagnetic phenomena. 5. To handle experimental equipment, carry out measurements and conduct physical analysis of them. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	• Written exams: solving exercises, demonstrating theoretical arguments. Depending upon the year, the evaluation will also be based upon two optional tests relating to laboratory subjects and/or the corection of laboratory reports.
Teaching methods	Board demonstrations, slide and activity presentations, experiments during formal lectures, laboratory work, exercise sessions. Although this is a BAC1 course, we believe it is important to focus on physical concepts through their mathematical description, starting from simple, everyday experiments such as Coulomb's, Ampère's and Faraday's laws. We will focus upon invariance concepts and the conservation of several physical quantities. The unification of these laws of physics in the concept of electric charge and the resulting electromagnetic interaction will be highlighted. As such, contrary to general physics courses usually provided in the sciences, significant emphasis will be placed upon the relativity between fields E and B via simple Lorentz transformations (provided in the framework of the general physics 1 course, and revisited further in this course). We will also set out Maxwell's laws by means of differential equations and not by means of integral equations. A more inductive approach will be offered in relation to laboratory hours, the number of which will be reduced in order to enable better intergration of the experimental approach (and to avoid only undertaking training in metrology there) in connection with the theoretical concepts developed during the course. Solving 'pedagogical' or even 'exam-type' exercises during formal lectures and exercise sessions. We will pose two types of problems in particular: those for which the physical system demonstrates significant symmetry and where the integral theorems allow for a quick resolution, and those for which the system is hardly symmetrical but where there is a sole, non-trivial degree of freedom, where the students will be steered towards handling and developing parametric equations in order to solve the problem. The tools offered will be developped in the course in exercise sessions and a list of exercises with solutions will be provided to the students.
Content	1) Electrostatics: concept of charges (charge density) and fields, Coulomb's law. 2) Electric potential: introduction to various mathematical tools (gradient, divergence). 3) Fields surrounding conductors: concept of conductor and capacity. 4) Electric currents: concept of current density, Ohm's law (physics explanation). 5) The field of charges in motion, transformation of the electric field, Ampère's law. 6) The magnetic field: definition, by Lorentz force, concept of curl, concept of vector potential and the Biot'Savart law.

	7) Introduction to electromagnetics and Maxwell's equations. Faraday's law, concept of electromotive force, concept of self-inductance, current and displacement. Maxwell's equations. 8) Circuit features and alternating currents, RL, LC and RC circuits. 9) Applied electric fields: polarisation, microscopic and macroscopic fields, field D. 10) Applied magnetic fields: origin of diamagnetism and paramagnetism, magnetisation, field H, ferromagnetic materials.
Bibliography	Cours de physique de Berkeley. Volume 2 : électricité et magnétisme.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	8		