UCL Faculté d'ingénierie biologique, agronomique et environnementale

AGRO

BIR1210 Physics II (with modern physics)

[60h+60h exercises] 9 credits

This course is taught in the 2nd semester

Teacher(s): René Prieels
Language: french
Level: 1st cycle course

Aims

To understand the time dependent electric and magnetic phenomenon. To be able to explain them thanks to the Maxwell equations. To show that the Maxwell equations also describe light as an electromagnetic wave. To compute voltages and currents in electric circuits powered with an alternate power supply. To explain and solve waves problems: interference, standing waves, polarisation, reflection, refraction, and diffraction. To use graphical method and compute mirror and lens problems. To debate and compute space-time properties in the special relativity framework, as well as the concept of mass-energy with the related relations. Be able to explain the quantification of matter. To comment the variety of nuclei, the disintegration modes, and the various applications. To compute nuclear masses, their binding energy and their radioactivity evolution.

Main themes

The first aim is to discover the beauty of the coherent explanation of the variety of electromagnetic manifestations through the Maxwell equations. The demonstration of the electromagnetic nature of light will follow. Modern Physics completes this unification with the special theory of relativity where energy an time is grouped in one four-dimension world, where energy and masse are equal. It follows in a common vision of the quantification of matter and light and of the four fundamental interactions interpreted through a propagator concept for each of them. Nuclear physics resumes the lectures describing the chart of nuclei, the decays, the energy balance in fission and fusion processes, and the numerous applications. This unified view of the physics world should sharpen the student curiosity and improve their skills and critics for the following years, in their study as well as in their professional carrier.

Content and teaching methods

Electromagnetic induction - Maxwell equations - Inductance - Magnetic field in matter, transformers. - Alternating currents - Electromagnetic waves, light in vacuum in matter, power of waves, antenna. - Reflection, refraction, polarisation, interferences, diffraction, gratings - Optics: mirrors, lenses. - Mechanical waves: standing waves, Doppler effect. - Special relativity: concepts of time, length, mass, energy, Doppler effect for electromagnetic waves.- Boltzmann distribution - Thermodynamics. - Black body radiation. - Quantum states of matter.- Is light matter?- Are particle waves? Wave length of particles - Probability wave function description of particles, Schrödinger equation. - Nuclear physics: chart of nuclei, masses, decays, fission, fusion, and nuclear reactors

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Précursory courses : PHYS 1100 'Physique générale I'
Evaluation : Written and oral examination
Books : Books of physics in French or in English: Giancoli, Benson, Hecht, Serway, Young.
Summary : none, but lecture's transparencies stored in the icampus web site of the UCL.
Methods : Lectures in main auditorium with experimental demonstrations, followed by periodic exercises and laboratory practices

Other credits in programs

BIR12	Deuxième année du programme conduisant au grade de candidat bio-ingénieur	(9 credits)	Mandatory