PHYS-201(d) **General physics: electromagnetism**

Grundler Dirk

Cursus	Sem.	Type
Electrical and Electronical Engineering	BA3	Obl.
HES - EL	H	Obl.
Materials Science and Engineering	BA3	Obl.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	**6 weekly**
Courses	4 weekly
Exercises	2 weekly
Number of positions	

Summary

The topics covered by the course are concepts of fluid mechanics, waves, and electromagnetism.

Content

Concepts of fluid mechanics
- Statics and dynamics of ideal fluids

Waves
- General understanding of wave motion, including energetic aspects
- Description of different waves propagating in a dense medium, refraction
- Superposition of waves: reflection, stationary waves, wave modulation, interference, and diffraction

Electromagnetism
- Electrostatics: Coulomb law and electric field, Gauss law, electric potential, capacity and energy, the electric fields in the dielectric matter
- Electrical currents and AC circuits
- Magnetostatics: the electrical currents and the magnetic field, the two fundamental laws, the magnetic properties of matter, ferromagnetism.
- The Faraday law: the emf force, the law of induction, self and mutual inductances, the magnetic energy
- Maxwell equations: the displacement current and Maxwell equations in vacuum and materials, electromagnetic waves, Poynting vector, energy considerations

Keywords

Electromagnetism, electricity and magnetism, interference, diffraction, Poynting vector, Maxwell's equations, vector calculus, div, grad, curl, Laplacian (in different coordinate systems), vector and integral identities

Learning Prerequisites

Required courses

General Physics I, II

Recommended courses

Mathematics courses 1st year

Learning Outcomes

By the end of the course, the student must be able to:

- Integrate topics of the course
- Manipulate equations given in the course

- Apply concepts given in the course to practical problems
- Solve problems using the concepts given in the course
- Choose appropriate method for solving a problem
- Deduce properties on the basis of fundamental laws
- Analyze quantitatively consequences of wave phenomena such as interference, diffraction, etc.

Transversal skills

- Use a work methodology appropriate to the task.
- Communicate effectively, being understood, including across different languages and cultures.
- Give feedback (critique) in an appropriate fashion.

Teaching methods

Ex cathedra with demonstrations and exercises supervised in class; clickers

Expected student activities

Attendance at lectures, completing exercises, revision of lecture contents, feedback (also via e.g. electronic means (clickers))

Assessment methods

Written Exam

Supervision

Office hours	Yes
Assistants	Yes

Resources

Bibliography

There are several textbooks that address concepts and aspects of the lecture (on different levels). Among them there are the following: (in French) M. Alonso and E.J. Finn: "Physique generale - 2. Champs et ondes", 2. Ed. - Dunod (Paris); F. A. Reuse, "Electrodynamique", PPUR; (in English) A. Zangwill, "Modern Electrodynamics", Cambridge University Press; (advanced level) J. D. Jackson, "Classical Electrodynamics, 3rd Edition, Wiley. Further textbooks that provide more examples/illustrations are available in the library (see below).

Ressources en bibliothèque

- Physics / Halliday
- Physics for Scientists and Engineers / Serway
- University Physics / Hudson

Notes/Handbook

Before the start of the lecture: please get a polling device (clicker) from the library (see link below).

Websites

- http://clickers.epfl.ch/students

Moodle Link

- http://moodle.epfl.ch/course/view.php?id=15266

Prerequisite for

General physics IV and Electromagnetism II