FOUNDATIONS AND TEACHING OF PHYSICS (800430)
ECTS credits: 6
Second year, first term

General program of contents and course objectives

The word physics is derived from the Greek word *physika*, wich means "natural things". In fact, physics is the study of the world and the universe. For some authors, physics is the science of matter and energy, and includes the principles that govern the motion of particles and waves, the interactions of particles, and the properties of molecules, atoms, and atomic nuclei, as well as larger-scale systems such as gases, liquids, and solids. Some consider physics the most fundamental science because its principles supply the foundation of the other scientific fields. Any law of physics comes from very close observation of the world, and any theory that a physicist, comes up with has to stand up to experimental measurements. This is the objective of the lectures and training program of this subject - introduction to the experimental measurements in physics. In addition, typical learning difficulties of Primary Education students will be conveniently discussed. In other words, the main objective is a *comprehensive treatment of Physics, in order to meet all the requirements of the Primary level syllabus*.

Program and course goals

The goals of the part of theory of the subject are:

- To develop a basic operational model of classical mechanics, with an emphasis on the foundations of vector algebra.
- To manage some basic concepts of and procedures of the discipline, so that the prospective teacher is able to create learning experiences that make the principles of physics accessible and meaningful for learners at a primary education level.
- To acquire abilities for posing and solving simple physical problems.
- Apply physics content knowledge in a creative, non-dogmatic, way, so that it can be used to engage the prospective learners in critical thinking, creativity, and collaborative problem solving related to actual issues.

Skills

- General: Design, plan and evaluate learning-teaching processes regarding experimental sciences field within the official syllabus.
- Transverse: team work, ICTs, environmental education, etc.
- Specific: Foundations of physics and everyday life problems associated to basic physics. The importance of physics to understand energetic and environmental challenges.

Aditional skills in physics

- To develop critical thinking skills & a basic understanding of how the science works.
- Become familiar with some basic mathematical operations.
- To develop models of physical problems suitable to be taught at a primary level.

Contents

Another issue to be considered, this program will focus primarily on a standard (classical) physics course. Thus, the program is divided into the following broad subject areas:

1. Units.
2. Describing motion.
3. Forces & energy.

4. Thermodynamics.
5. Electricity and Magnetism.
6. Optics

Presentation format and methodology

- Theory lectures: The course will consist of practical lectures, in-class discussions, in-class exercises and small group work. Cooperation will be encouraged in order to take advantage of the experience of the students who have more experience in physics.

- Practical work at the lab: Students (in groups) have to keep a lab notebook where they must record their own class lecture notes, ideas, questions, and notes that are part of any pre-lab preparation. For each lab study, should include title of the lab study; introduction and objectives; materials, detailed procedures and data (recorded in the lab itself, recording everything done in the lab); summary. Because of the experimental nature of the material covered in the program, regular attendance at the lab is expected. In fact, this will be part of the mark of the practical activities.

Exams and Grading

The final mark of the whole "Physics" course (theory and practice) will be based on a final written (theory) exam (60%), plus the practical activities (40%) i.e. lab attendance and lab notebooks.

Important, an average mark equal or greater than five (5) is required to pass the course both in the activities and the official (theory) exam.

References

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- Richard R. Hake, Interactive-Engagement vs. Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. American Journal of Physics, 66, pp. 64, 1998.
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