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370502 - FÍSICA - Physics

Coordinating unit: 370 - FOOT - Terrassa School of Optics and Optometry
Teaching unit: 731 - OO - Department of Optics and Optometry
Academic year: 2019
Degree: BACHELOR'S DEGREE IN OPTICS AND OPTOMETRY (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 7,5 Teaching languages: Catalan

Teaching staff

Coordinator:
NURIA LUPON BAS (http://futur.upc.edu/NuriaLuponBas)

Others: Primer quadrimestre:
NURIA LUPON BAS (http://futur.upc.edu/NuriaLuponBas)
JAUME ESCOFET SOTERAS
JESÚS ARMENGOL CEBRIAN

Prior skills

As will be seen later in the section of content, the course has a very basic character. This makes the knowledge necessary for proper use are minimal. Any student who was not connected to a Degree in Optometry will be able to complete the course with profit.

Having the knowledge taught in high school Physics and Mathematics to help track more comfortable on the course.

Degree competences to which the subject contributes

Specific:

1. Understanding the physical basis of the behavior of fluids and the nature, generation and propagation of light, to understand their role in their own processes and applications of optics and optometry.
2. Being able to take, treat, represent and interpret experimental data. "Use basic laboratory equipment and techniques"

Generical:

3. Adaptation of all the fields of professional activity envers compatible aspects with the medium ambient (recycling, reuse of the materials,...)
4. Capacity to assume different roles within the team, leadership, coordination with other members
5. Extract the main points of a text or any source of information (oral or written)
6. Flexibility to integrate into dynamic environments, multidisciplinary and multicultural.
7. Synthesize and organize information to convey it effectively orally and / or written
8. Working with evidence, methodology and rigour.

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Teaching methodology

The lectures provided in activity 1 consist of the presentation of topics by faculty, logical structure information according to appropriate criteria to the course objectives described above.

In their problem sessions and preparation, provided the activities 2 and 3, ask the students to develop appropriate solutions or right through the exercise routines, applying formulas or algorithms, the application of transformation procedures available information and interpretation of results.

As regards the preparation and conduct of laboratory practice, under activities 4 and 5, students are asked to intensive analysis of a particular physical situation in order to know, interpret, solve, generate hypotheses, comparing the data, reflect on it, complete knowledge, or anticipate. These two activities are done working in groups of 3 (preferably) to 4 members with the aim to incorporate generic skills related to teamwork. On the other hand, allow the labs to develop basic skills such instrument, and introduces students to the application of scientific method in solving problems specific pilot.

In all cases the support material used in the form of detailed teaching plan by Athena: content learning goals, concepts, examples, programming and evaluation activities directed learning and literature

Learning objectives of the subject

With the course aims to:
- Briefly review the basic concepts of mechanics as part of the language of physics that are used throughout the course.
- To understand the physical basis of the behavior of fluids and surface phenomena, the physical quantities necessary to do so, the main laws that relate.
- Introduce wave phenomena based on oscillations and mechanical waves.
- To study them one-dimensional mechanical waves: generation, propagation medium changes, mathematical description, overlapping, energy and intensity. Generalize these concepts to 2D and 3D case.
- Enter the electric and magnetic fields to reach the electromagnetic field and electromagnetic waves.
    - Studying the interaction force between electric charges, and to deepen the concept of electric field in the electrostatic case.
    - Explain the main phenomena related to the magnetic field and the experimental laws that describe them: magnetic force and magnetic field generation.
    - Describe the electromagnetic waves only in the case of plane waves and harmonics.
- To present different measurement instruments through their manipulation in the laboratory.
- To introduce students to the scientific method in what concerns the interpretation of experimental data and graphs.

Study load

Total learning time: 185h	Hours large group:	0h	0.00%
	Hours medium group:	49h	26.49%
	Hours small group:	26h	14.05%
	Guided activities:	5h	2.70%
	Self study:	105h	56.76%

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Content

1. MECHANICS. BASICS CONCEPTS

Learning time: 22h

Practical classes: 6h
Laboratory classes: 4h
Self study : 12h

Description:

1. VECTOR (1.-scalar and vector magnitudes. 2.-Vector. Vector algebra. 3.-unit vector. Cartesian components. 4. Scalar product of two vectors. 5. Product of two vectors. 6. Vector analysis.)

2. Kinematics (1. Rectilinear movement. Reference System 2.. Speed. 3. Acceleration. 4. Rectilinear motion with constant acceleration. 5. Motion in two and three dimensions. Reference System. 6. Circular motion with constant speed module. angular velocity. centripetal acceleration.)

3. NEWTON'S LAWS (1. Fundamental principles of dynamics. The laws of Newton. 2.-The forces of nature.)

4. DYNAMICS OF PARTICLE (1. Work. Unit 2.. Kinetic Energy 3.. Conservative Forces. Potential energy. 4. Conservation of mechanical energy 5.. Power. Units.

Specific objectives:

After completing the module students will be able of:

- Apply Newton's laws to solve simple mechanics problems
- Apply the principle of conservation of energy to solve simple mechanics problems

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2. MECHANICS OF SOLIDS AND FLUIDS.

Learning time: 40h

Practical classes: 12h
Laboratory classes: 4h
Self study : 24h

Description:

5. Elastic properties of the materials (1. Elastic body. 2. Elasticity in tension or compression. 3. Uniform compression.)

6. STATIC FLUID (1. Introduction. Overview fluids. 2. Pressure inside a fluid. Pascal's. 3. Statics of fluids in the gravity field. Pressure 4.. Pressure Units 5.. Top Archimedes.)

7. DYNAMICS OF IDEAL FLUIDS (1. Description of motion of an ideal fluid. Streamlines 2.. Flow Regimes. The ideal fluid. 3. Flow. 4. Continuity equation. 5. Bernoulli's theorem. Interpretation energy 6. . Applications of Bernoulli's theorem. venturi effect. theorem Torricelli.

8. Viscous fluid dynamics (1. The movement of real fluids. Viscosity. 2. Laminar flow of a viscous fluid through a tube. Hagen Poiseuille Law. Pressure Drop 3.. Stokes' Law. Sedimentation.)

9. Cohesio FORCE IN Liquids (1. Intermolecular forces in liquids. Cohesion. 2. Surface Tension 3.. Contact between solid and liquid. Membership.)

Specific objectives:

Upon completion of the module the student will be able of :

- Describe the concept of density of a substance.
- Calculating the Hooke's law by the deformations of a body when a force is applied in some cases especially interesting.
- Describe the concepts of pressure inside a fluid flow of a fluid flow and viscosity of fluids.
- Apply the fundamental laws of statics and dynamics of ideal and viscous fluids in laminar and stationary problems and situations involving simple fluids at rest and / or moving.
- Describe qualitatively the role of cohesive forces in liquids and of adhesion between solids and liquids in relevant cases in the context of Optometry.

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3. OSCILLATIONS AND WAVES.

Learning time: 44h

Practical classes: 14h
Laboratory classes: 2h
Self study : 28h

Description:

10. SWINGS (1. Simple harmonic motion. Equations of Motion 2. Oscillation of a mass on a spring. Elastic Potential Energy 3. Oscillations damped.)

11. DESCRIPTION OF WAVE MOTION IN ONE DIMENSION (1. Pulse waves. Pulse longitudinal and transverse pulses. 2. Wavefunction. 3. Velocity of propagation of a pulse on a rope. 4. Reflection and transmission of pulses. 5. Harmonic waves in one dimension. 6. Parameters characterizing a harmonic wave. 7. Energy and intensity of a harmonic wave. Absorption.. 8 The wave equation. 9.-sound waves.)

12. OVERLAP OF WAVES IN ONE DIMENSION (1. Interference. Superposition Pulse 2.. Superposition of two harmonic waves. 3. Stationary wave functions 4.. Waves in a corda fixed at both ends.

13. Wave motion in two and three dimensions (1. Ondas 2D and 3D waves. 2. Wavefront. Rayo. 3. Plane waves, circular and spherical. 4. Propagation of the wave energy associated with 2D and 3D. Intensity 5. . The Principle of Huygens. reflection refraction and diffraction. 6. Doppler Effect.)

Specific objectives:

Upon completion of the module the student will be able of Do

- Apply the harmonic functions to the description of simple harmonic motion.
- Apply the equations of simple harmonic motion to solve problems involving the motion of a body attached to the end of a pier or driven by a spring.
- Determine the speed of propagation of waves.
- Apply the harmonic functions to the description of waves propagating in half dimensional.
- Correctly use the language associated with the description of the waves.
- Plot the wave function in the one-dimensional case in a specific point in space or in an instant of time.
- To know the result of interference of two-dimensional waves traveling in the same direction, with the same amplitude, frequency and wavelength for use in solving simple problems of interference.
- Describe the waves in a pro set corda both ends and solve basic problems on this physical situation.
- Determine qualitatively the intensity associated with a wave in practical cases.

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4. ELECTROMAGNETISM.

Learning time: 53h

Practical classes: 17h
Laboratory classes: 2h
Self study : 34h

Description:

14. MATHEMATICAL INTRODUCTION (1. Scalar fields and vector fields. 2. Flow of a vector field. Integral surface. 3. Circulation of a vector field. Integral line.)

15. The electrostatic field (1. Electric charge. Electrical structure of matter. 2. Coulomb's Law. Loading Units 3.. The electric field 4.. Field lines. 5. Electrostatic potential energy. 6. Electric Potential.)

16. Conductors and dielectrics (1.-conductors and dielectric materials. 2.-load free, bound charge and net charge. 3.-Behavior of conductive materials under the action of an electrostatic field. 4.-Behavior of dielectric materials subjected to action of an electrostatic field. Polarization of the dielectric. dielectric constant.)

17. CURRENT (1. The power. Movement of cargo. 2. Ohm's Law. Resistance 3.. Energy balance in electric circuits: Joule effect, generators and electromotive force.)

18. MAGNETIC FIELD (1. Introduction 2.. Action of a magnetic field on a moving charge: Lorentz force. Definition of the magnetic field B. 3. Example: movement of a point charge in a uniform magnetic field. 4. Action a magnetic field on a current element on a loop and a coil. Magnetic moment of loop 5.. Action of a magnetic field on a magnet. Magnetic moment of a magnet. magnetic attraction and repulsion. 6. Sources of field magnetic. Biot and Savart. 7. Magnetic field created by a coil, a coil, a magnet, a wire straight and indefinite and a moving charge.)

19. MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES (1. Maxwell's equations. Ampère Law board. 2. Electromagnetic waves. Wave equation 3.. The electromagnetic spectrum. 4. Generation of electromagnetic waves. 5. Atomic structure of materials. 6. light sources.)

Specific objectives:

Upon completion of the module the student will be able of:

- Calculate the strength of electrical interaction between two or more electrically charged bodies.
- Calculate the electric field and potential generated by different charge distributions at points in the surrounding space.
- Describe the interaction of the electrostatic field with conductors and dielectrics.
- Calculate the magnetic force experienced by a moving charge or a current element located in an area of ¿¿space where a magnetic field.
- Calculate the magnetic field generated by different distributions of electrical current.
- Learn to distinguish cases, an induced current in a conducting loop, and which not.
- Describe formally plane electromagnetic waves and harmonics.

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5. LABORATORY.	Learning time: 21h Laboratory classes: 14h Self study : 7h

Description:
1.-Recycling and reuse of materials in the physics laboratory.
2.-Newton's Second Law.
3.-Graphical representation of data. Linear regression.
4.-Pressure in a fluid and its measure.
5.-Determination of the coefficient of viscosity.
6.-Elastic constant of a spring.
7.-Waves on a string.
8.-2D and 3D waves.
9.-Factors upon which the electrical resistance.
10.-Magnetism.

Specific objectives:
Upon completion of the module the student will be able of:

- Handle different types of timers and various devices to measure lengths very accurately.
- Apply a previously studied physical law to specific experimental situations.
- Compare the results of measuring the same magnitude in different ways and know how to explain any discrepancies.
- Plot the results of the measurement of two physical quantities related to each other and to establish, from the graph, the mathematical equation that relates them.

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Planning of activities

1. ACTIVITY 1	Hours: 56h Practical classes: 24h Laboratory classes: 2h Self study: 30h

Description:
Exhibition class attendance. The student works in the classroom.

Support materials:
Printed summaries of each lesson plus graphic material used in class available in printed version or Athena platform.

2. ACTIVITY 2	Hours: 50h Self study: 50h

Description:
Solving problems through individual work.

Support materials:
List of problems with their solution. Solved problems available at the Atenea platform.

3. ACTIVITY 3	Hours: 29h Practical classes: 25h Laboratory classes: 4h

Description:
Sessions of problems i the classroom.

Support materials:
List of problems with their solution. Solved problems available at the Atenea platform.

4. ACTIVITY 4	Hours: 7h Self study: 7h

Description:
Preparation for practice. Teamwork.

Support materials:
Lab guide notes. Listing of summaries and class presentations. Bibliography.

5. ACTIVITY 5	Hours: 14h Laboratory classes: 14h

Description:
Realization of practices. Group work in the laboratory.

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Support materials:
Lab guide notes. Tools for graphics.

6. ACTIVITY 6	Hours: 24h Laboratory classes: 6h Self study: 18h

Description:
Problem evaluation sessions. They require a previous preparation, consisting in solving three problems proposed by the teacher, which will be discussed during the first hour of the session. During the second hour there will be a written test.

Support materials:
Dossier of problems with their solutions and solved problems available at the Atenea platform.

Qualification system

Exercise Class 1: Questionnaire Test (conceptual and numerical) 10%
Exercise Class 2: Quiz test (conceptual and numerical) 10%
Exercise Class 3: Questionnaire Test (conceptual and numerical) 10%
Problem: Problem evaluation sessions 10%
Final Exam: Problem (3) + Conceptual justification of the approach used to solve them 50%
Lab: Attendance + sheet preparation and delivery + delivery of results 10%

Reassessment of Physics will be taken according to general rules established in the “Normativa general de Graus i Màsters de la UPC” and to particular rules form the “Facultat d ’ Òptica i Optometria de Terrassa”. It will be a single final exam covering all the subjects of the course.

A final grade of 5 will be awarded to students passing this exam, otherwise the previous grade will remain.

Regulations for carrying out activities

To profit by activities 1, 2 and 3 were evaluated in 4 controls spread over the course described in the previous section, which are both class exercises and both tests.

Activities 4 and 5 are evaluated directly each week.

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Complementary:

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Gettys, W. Edward. Física para ingeniería y ciencias. 2a ed. Mèxic: McGraw-Hill, 2005. ISBN 9701048938.

Giancoli, Douglas C. Física para universitarios. 3a ed. Mèxic: Pearson Education, 2002. ISBN 9684444842.

Alonso, Marcelo. Física. Mèxic: Addison Wesley Longman, 2000. ISBN 9684444265.

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Others resources: