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250104 - FÍSICA - Physics

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 748 - FIS - Department of Physics

Academic year: 2018

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: ORIOL BATISTE BOLEDA, DANIEL CALVETE MANRIQUE

Others: ORIOL BATISTE BOLEDA, DANIEL CALVETE MANRIQUE, FRANCISCO MARQUES TRUYOL, CARLES PANADES GUINART

Degree competences to which the subject contributes

Specific:

3056. Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics and electromagnetic fields and waves, and their application in solving engineering problems.

Transversal:

591. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

597. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

600. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

On average, the course consists of 2(Th.) + 2(P) hours per week of classroom activity.

The 2(Th) hours are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 2(P) hours is devoted to solving practical problems in order to consolidate the general and specific learning objectives.

During the four weakly lecture hours there will be short gradable exercices.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Learning objectives of the subject

Students will acquire advanced knowledge of physics of the general laws of thermodynamics, electromagnetism and fields and waves and of the fundamental principles upon which they are built. Students will also learn how these laws can be used to solve engineering problems.

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On completion of the course, students will have acquired the ability to:
1. Infer general thermodynamic principles and apply them to basic engineering problems;
2. Infer and apply the concepts of fields and waves in engineering;
3. Solve practical electromagnetism problems.

Basic principles of thermodynamics, including the first and second laws, enthalpy and entropy, heat transmission and the basic concepts of kinetic theory of gases; Basic principles of wave propagation, in particular as applied to acoustic problems; Electromagnetism, including its applications in engineering

Study load

Total learning time: 150h	Hours large group:	28h	18.67%
	Hours medium group:	20h	13.33%
	Hours small group:	12h	8.00%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

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Content

Continuum Media

Learning time: 19h 12m

Theory classes: 4h
Practical classes: 4h
Self study : 11h 12m

Description:
Efforts. Deformation. Tension. Modules of elasticity. Elasticity and plasticity. Molecular model of elasticity
Examples and problem solving
Density. Pressure in a fluid. Forces against a dam. Archimedes Principle. Flotation
Examples and problem solving
Turbulent and laminar flow. Steady flow: continuity equation. Energy conservation: the Bernoulli equation.
Applications of Bernoulli's equation. Viscosity. Reynolds number. Poiseuille law. Stokes' law.
Examples and problem solving

Thermodynamics and heat tranfer

Learning time: 43h 12m

Theory classes: 10h
Practical classes: 8h
Self study : 25h 12m

Description:
Thermal equilibrium and temperature. Principle "zero" of thermodynamics. Thermometers and temperature scales. Equations of state. Ideal gas equation. And thermal expansion efforts.
Examples and problem solving
Phases of matter. Phase diagrams. Amount of heat. Heat capacity. Phase changes and latent heat.
Examples and problem solving
Heat transfer. Conduction: Fourier's law, thermal resistance. Convection. Radiation: Stefan-Boltzmann law.
Newton's Law of referedament
Examples and problem solving
Systems and thermodynamic processes. Work, internal energy and heat. First principle. Types of thermodynamic processes: adiabatic, isocoro, isothermal and isobaric. Processes strangulation. Ideal gas: internal energy, heat capacity and adiabatic processes.
Examples and problem solving
Heat engines and refrigerators. Heat Pumps. Second law of thermodynamics. Carnot cycle.
Entropy. Irreversibility. Conversion of energy and usable energy. Microscopic interpretation of entropy.
Examples and problem solving
Examples and problem solving

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Mechanical oscillations and wave phenomena

Learning time: 64h 48m

Theory classes: 11h
Practical classes: 12h
Laboratory classes: 4h
Self study : 37h 48m

Description:
Restore balance and strength. Small amplitude oscillations. Simple harmonic motion. Power simple harmonic motion and initial conditions. Damped oscillations. Forced oscillations and resonance.
Examples and problem solving
Types of mechanical waves. Pulses and periodic waves propagation speed. Mathematical representation of a wave. Wave equation. Waves on a string, waves on a wire.
Examples and problem solving
Energy, power and intensity of a wave. Spherical waves.
Examples and problem solving
Propagation on inhomogeneous media. Reflection, transmission and refraction.
Examples and problem solving
Superposition principle. Fourier analysis of wave motion. Interference. Standing waves and normal modes.
Examples and problem solving
Pressure waves in a solid, a liquid and a gas. Acoustic waves, sound. Intensity and scale of decibels. Standing waves and normal modes.
Examples and problem solving
Wave packet and dispersion. Group velocity and dispersion. Doppler effect.
Examples and problem solving
Treatment of experimental data
Speed of sound

Electricity, circuits and experimental techniques

Learning time: 4h 48m

Laboratory classes: 2h
Self study : 2h 48m

Description:
Electrical Circuits

Evaluation

Learning time: 12h

Laboratory classes: 5h
Self study : 7h

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Qualification system

The final mark is obtained from the weighted sum detailed below:

N_T: mark corresponding to 1st exam (thermodynamics and continuum media)
N_O: mark corresponding to 2nd exam (oscillations and wave phenomena)
N_C: mark corresponding to exercices and other activities made in the classroom during the course
N_P: marks lab reports

N_FINAL= 0.30 * N_T + 0.30 * N_O + 0.30 * N_C + 0.10 * N_P

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

Regulations for carrying out activities

Not attending to any of the three programmed exams will result in a numerical mark of 0.0 for that particular exam. Under exceptional conditions (illness or professional activity, officially justified) an extra exam will be arranged.

Bibliography

Basic:

Tipler, P.A.; Mosca, G. Física para la ciencia y la tecnología. 6a ed. Barcelona: Reverté, 2010. ISBN 9788429144284.

Young, H.D.; Freedman, R.A. Física universitaria con física moderna. 1a ed. México: Pearson Educación de México, S.A. de C.V., 2018. ISBN 9786073244398.