Course guide
310609 - 310609 - Electromagnetism and Optics

Last modified: 10/01/2024

Unit in charge:	Barcelona School of Building Construction
Teaching unit:	748 - FIS - Department of Physics.

Degree:	BACHELOR'S DEGREE IN GEOINFORMATION AND GEOMATICS ENGINEERING (Syllabus 2016). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	Laureano Ramírez de la Piscina Millán
Others:	Adrià Tauste Campo Blas Echebarria Domínguez

PRIOR SKILLS

Trigonometry
Elementary algebra.
Vectorial calculus.
Differential and integral calculus.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Comprehension and domination of the basic concepts about the general laws of mechanincs, thermodinamics, fields, waves and electromagnetism and its application for the resolution of engineering's own problems.

Transversal:
2. 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.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. 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

During the face-to-face learning hours, lectures are alternated with classes for solving exercises and problems. In the lectures, in large groups, the teachers make a theoretical presentation to introduce the basic concepts of the subject, and carry out examples on their practical application. The classes for solving exercises and problems are carried out in a medium group, and they alternate the resolution of practical exercises and problems by the student with the clarification of the most problematic points by the teacher. The teachers also propose to the student, both in person and through the Atenea platform, exercises and problems aimed at autonomous learning.
In addition, material on some topics will be given for the student to study independently.

LEARNING OBJECTIVES OF THE SUBJECT

Understanding and mastery of the basic concepts of the laws of electromagnetism and optics

STUDY LOAD

Type	Hours	Percentage
Hours large group	24,0	16.00
Hours medium group	36,0	24.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

C1 Oscillations and waves

Description:
Periodic motion. Oscillations. Simple harmonic motion.
Damped and forced oscillations.
Wave phenomena. Study of different types of waves.
Energy, power and intensity.
Doppler effect.
Principle of superposition. Stationary waves. Fourier's theorem.
Interference and diffraction.

Related activities:
Evaluation of the midterm and final exams.

Full-or-part-time: 33h
Theory classes: 5h
Practical classes: 8h
Self study : 20h

C2 Geometric optics

Description:
Fermat´s principle. Refraction and reflexion.
Spherical dioptrics. Mirrors.
Lenses. Thin lenses. Coupling.
Optical instruments.

Related activities:
Evaluation of midterm and final exams.

Full-or-part-time: 42h
Theory classes: 7h
Practical classes: 10h
Self study : 25h

C3 Electric and magnetic fields

Description:
Electric charges. Coulomb's law.
Electric field. Gauss's law. Applications.
Electric potential and potential energy.
Magnetic field. Lorentz force. Magnetic force on a conductor with current.
Biot-Savart's law Ampère's law.
Magnetism in matter.

Related activities:
Evaluation of midterm and final exams.

Full-or-part-time: 67h
Theory classes: 10h
Practical classes: 16h
Self study : 41h

C4 Light and radiation

Description:
Electromagnetic nature of light
Light propagation. Huygens' principle
Radiation. Planck's, Wien's and Stefan-Boltzmann's laws.

Related activities:
Evaluation of midterm and final exams.

Full-or-part-time: 4h
Theory classes: 1h
Practical classes: 1h
Self study : 2h

C5 Photometry and colorimetry Fotometria i colorimetria

Description:
Characteristics of vision.
Luminous flux. Luminous efficiency.
Point and extensive sources. Illumination of a surface. Lambert's law.
Color attributes. Color additivity and Grassmann's laws.
Color specification. RGB method. CIE system.

Related activities:
Evaluation of midterm and final exams.

Full-or-part-time: 4h
Theory classes: 1h
Practical classes: 1h
Self study : 2h

ACTIVITIES

PE1 first test (25%)

Full-or-part-time: 2h
Theory classes: 2h

PE2 Second Test (25%)

Full-or-part-time: 2h
Theory classes: 2h

ExFin Final Exam (50%)

Full-or-part-time: 3h
Theory classes: 3h

GRADING SYSTEM

- First partial (PE1) is carried out during the whole week, the first half of the syllabus enters and its weight is 25% in the weighted average grade.
- Second partial (PE2) is carried out at the end of the semester, enters the second half of the syllabus, and its weight is 25% in the weighted average grade.
- The ExFin final exam includes all the contents. Its weight is 50% in the weighted average grade.

In accordance with the Academic Regulations for Undergraduate and Master's Studies of the UPC and EPSEB, the final evaluation of the subject will be carried out as described below.

The final grade for the course will be the higher of the following two grades:

a) m weighted arithmetic mean of the qualifications corresponding to the practical deliverables and the final exam, obtained according to the relationship

$$m = 0.25\ p + 0.25\ s + 0.5\ f$$

being

p = qualification of the first practical deliverable PE1
s = qualification of the second practical deliverable PE2
f = Final exam grade

b) f qualification of the final exam ExFin

The autonomous learning transversal competence (CT7.1) is passed when the subject is passed.

Re-evaluation

The student who has obtained a final failing grade with a numerical grade between 3.5 and 4.9 will have the option of taking a single re-evaluation test, which will include all the Contents and will be carried out in the period established for that purpose. If you pass this test, the final grade for the course will pass (5.0)
The student who meets any of the following conditions will not be able to take the reevaluation test:
i) has already passed the course
ii) their final grade is below 3.5 (includes the NP case, which is NP 0)

EXAMINATION RULES.

The delivery of any of the final exams eliminates the possibility of having a 'no shown'.
The delivery of the examination of recovery of the partial exams supposes the substitution of the qualification of the same ones by the new qualification to all the effects.
To take the re-evaluation exam, it is necessary to have taken the final exam, and have an overall grade for the course between 3.5 and 4.9.
The maximum mark of the re-evaluation exam will be 5.
- You cannot enter the exam once it has started.
- You cannot have your mobile phone during the exam.

BIBLIOGRAPHY

Basic:
- Tipler, P.A. ; Mosca, G. Física para la ciencia y la tecnología. 5a ed. Barcelona: Reverté, 2005. ISBN 9788429144109.
- Sears, F.W. ; Zemansky, M.W. ; Young, H.D. Física universitaria. 11a ed. México: Pearson Educación, 2004.