

Name: Acoustic waves. Ultrasounds - 11501**Type:** elective**Semester:** 1st**ECTS:** 5**Periodicity:** annual**Departments involved:** Department of Applied Physics (UPC)**Coordinator:** Rafel Pérez Pérez**Professors:** Rafel Pérez Pérez**Language:** Catalan / Spanish / English**Prerequisite:****Aims:**

The aim of this course is to provide the physical fundamentals of the propagation of acoustic waves in fluids and solids, and of its generation and absorption, by focussing mainly in the study of high frequencies (ultrasound). We will study the use of ultrasounds in a wide range of applications: Image generation, non destructive test, sensors, oscillators, delay lines and electronic filters.

Syllabus:

- Applications of ultrasonic waves.
- Fundamentals of vibrations and waves. Normal modes of vibration.
- Acoustics in fluids. Propagation velocity. Energy. Impedance. Attenuation.
- Radiation. Diffraction phenomena.
- Acoustics in solids. Stress and strain. Elasticity. Propagation in isotropic solids
- Acoustics in crystals. Propagation in anisotropic solids. Characteristic surfaces.
- Transmission and Reflection phenomena. Change of medium. Normal and oblique incidence.
- Surface waves and guided waves. Rayleigh and Lamb waves.
- Piezoelectricity. Electromechanical coupling.
- Piezoelectric transducers.
- Resonators and filters. The quartz oscillator.
- Surface acoustic waves devices (S.A.W.). The use of interdigital transducers.
- Other applications: Sensors, non destructive test (N.D.T.), Acoustooptics.

Method:

- Theoretical development.
- Simple examples. Individual work.
- Complex examples. Work in group.
- Some experimental measurements.

Evaluation:

50% Final examination

50% Partial examination and a work in group

Bibliography:

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- Kino, G.S. Acoustic waves. Prentice – Hall, 1987.
- Royer, D.; Dieulesaint, E. Ondes élastiques dans les solides. Masson, 1996.
- Rosenbaum, J.F. Bulk Acoustic Wave. Artech House, 1988.
- Nye, J.F. Physical Properties of Crystals. Oxford, 1985.
- Gerber, E.; Ballato, A. Precision Frequency Control. Academic Press, 1985.
- Kinsman, R.G. Crystal Filters, John Willey, 1987.
- Campbell, C.K. Surface Acoustic Wave Devices. Academic Press, 1998.
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