Universidad Zaragoza

Academic Year/course: 2024/25

26947 - Spectroscopy

Syllabus Information

Academic year: 2024/25
Subject: 26947 - Spectroscopy
Faculty / School: 100 - Facultad de Ciencias
Degree: 447 - Degree in Physics
ECTS: 5.0
Year:
Semester: Second semester
Subject type: Optional
Module:

1. General information

The objective of the subject is to provide the student with an overview of different spectroscopic techniques (optical, paramagnetic resonance, X-ray, etc.) used in the characterization of 3d ions and rare earth elements in solids and of the lattice vibrations in bulk material, as well as in the study of surfaces. The analysis of the role of symmetry will be basic for the interpretation of the information obtained by the different spectroscopic techniques to simple systems.

It is recommended to have taken the subjects Quantum Physics I and II, Optics and Solid State I.

2. Learning results

The Spectroscopy subject allows the student to acquire the necessary skills for the characterization of magnetic atoms or ions in solids from a spectroscopic point of view . The learning results will enable students to:

- Correctly interpret the effects of weak, intermediate and strong crystal field approximations on the electronic structure of ions and molecules.
- Obtain the selection rules associated with symmetry for transitions between electronic states and vibrations of ions and molecules.
- Interpret the basic information obtained by applying the different spectroscopic techniques to simple systems
- Recognize the elements on which the choice of each spectroscopic technique is based for the characterization of molecular systems or specific solids

3. Syllabus

- Introduction. Point group theory.
- Crystalline field and its different approaches. The role of the symmetry of the environment on the electronic structure.
- Optical spectroscopy: absorption and emission
- The symmetry of molecules and their normal modes of vibration. Infrared spectroscopy and Raman spectroscopy Basic instrumentation in electronic paramagnetic resonance.
- The spin Hamiltonian and the interpretation of electron paramagnetic resonance spectra
- Other spectroscopic techniques.

4. Academic activities

The activities foreseen in this subject are the theory classes, the problem classes, the resolution of problems by the students (to be discussed in class or corrected by the teacher), and the practical sessions in the laboratory and subsequent report preparation.

- The master classes dedicated to theory will be taught in 35 hours, according to the schedules established by the center.
- The master classes dedicated to problem solving will be taught in 10 hours, according to the schedules established by the center.
- The laboratory practices will be carried out in 5 hours, at a time agreed upon with the teacher in charge.

- Students' papers and reports must be submitted before the date of the final exam.
- Evaluation sessions: The date of the evaluation session by means of a written test (final exam) is established by the Faculty of Sciences and is published each year on its website.

The tutoring schedule will be agreed with the students at the beginning of the term.

5. Assessment system

5. Assessment System

The student must demonstrate that they has achieved the intended learning results through the following assessment activities:

- **Option 1**.
  - Completion and delivery of problems (as a rule in writing form, complemented by oral presentation) of the subject taught during the four-month period. The grade of the deliveries will constitute 35% of the final grade.
  - Laboratory practices throughout the teaching period. Students must submit a written report for each of the laboratory sessions conducted. The grade of these reports will constitute 15% of the final grade.
  - Written test, carried out at the end of the four-month period, which will constitute 50% of the overall result.
- **Option 2**.
  - Passing the subject by means of a single global test. The evaluation will be obtained directly from a two-part examination test: Examination of questions and problems corresponding to the subject explained during the four-month period, which will constitute 85% of the final grade.
  - Practical exam (15%), which will consist of the resolution of several practical cases similar to those carried out by the students in the classroom laboratory sessions.

6. Sustainable Development Goals

4 - Quality Education