COURSE DATA

DATA SUBJECT

Code: 42932
Name: Techniques for the study of crystalline solids
Cycle: Master's Degree
ECTS Credits: 2
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period

SUBJECT-MATTER

Degree	Subject-matter	Character

COORDINATION

MARTI GASTALDO CARLOS

SUMMARY

Laboratory Subject dedicated to the learning of advanced work methodologies used in the techniques used in the study of crystalline solids, such as electron microscopy, or the powder diffraction of x-rays.

Regarding the Sustainable Development Goals (SDGs), it is expected that students will be able to know in this subject how to apply the knowledge learned to guarantee an inclusive, equitable, and quality education and promote learning opportunities for everyone (SDG 4), to acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (SDGs 11 , 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient products, chemical processes, and analytical methodologies (SDG 7) that minimize their impact on the environment (SDGs 14 and 15), using alternative raw materials and reducing wastes (SDG 11).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Prior knowledge of chemistry and experimental work in the laboratory of chemistry taught in the degrees indicated in the recommended income profile for the student of the master's degree are required.

COMPETENCES / LEARNING OUTCOMES

2109 -

CG1 - Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.

Realizar estudios realacionados con el análisis y/o la caracterización de sustancias químicas tales como: control de calidad, diseño de protocolos de trabajo para laboratorios, diseño e implementación de procesos de acreditación y validación, diseño y desarrollo de proyectos I+D+I, emisión de informes, certificaciones y/o dictámenes, etc.

Seleccionar la instrumentación química comercializada apropiada para el estudio a arealizar y de aplicar sus conocimientos para utilizarla de manera correcta.

Ser capaces de emplear las herramientas básicas para el tratamiento de datos experimentales en el laboratorio.

Ser capaces de planificar y gestionar los recursos disponibles de un laboratorio químico, teniendo en cuenta los principios básicos de la calidad, prevención de riesgos, seguridad y sostenibilidad.

Ser capaces de seleccionar y optimizar las variables instrumentales para obtener los mejores parámetros analíticos en las técnicas experimentales estudiadas.

To acquire basic skills to develop laboratory work in biomedical research.

To prepare a clear and concise memory of the results of your work and the conclusions obtained.

DESCRIPTION OF CONTENTS

1. Electronic microscopy

- Sample preparation from powder materials (inorganic products, minerals, ceramic materials) for scanning electron microscopy (SEM).
- Observation and microstructural characterization through MEB.
- Optimization of the control parameters of the MEB equipment for obtaining high resolution images.

2. X-ray diffraction (XRD)
Powder Diffraction of X-rays (XRD)

- Sample preparation from powder materials (inorganic products, minerals, ceramics) and materials in piece (ceramics, metals and alloys) for consideration by XRD.
- Establishment of the optimum parameters for obtaining diffraction standards of crystalline samples.
- Obtaining the diffraction patterns of the samples prepared.
- Identification of crystalline phases in single-phase samples.
- Identification of crystalline phases in multiphasic samples.
- Determination of crystalline phases in a material.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Total hours	**0,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	5,00
Independent study and work	16,00
Preparation of lessons	0,00
Preparation for assessment activities	4,00
Resolution of case studies	5,00
Total hours	**30,00**

TEACHING METHODOLOGY

Presential Activities

Laboratory classes will begin with seminars in which Professor will perform a brief introduction of the objective, fundamentals and experimental practices methodology to perform.

The teacher will held in the laboratory the necessary explanations on operation of the instruments to be used in each practice prior to their use by students and will supervise its use during practices, to enhance knowledge on the techniques used.

Students will carry out the practice following the corresponding protocols or manual of practices.

Classroom activities performed in the laboratory, presentations and exhibitions of works will be part of the ongoing evaluation of the student (formative activities AF2 of verifica and teaching methodology MD1 of verifica)

Written examinations of the subject will be carried out on the date specified in the programming of the assessment tests (formative activities AF4 of verifica and teaching methdology MD1 of verifica).

The competences to acquire from the presential activities will be:

- Generals: CG1 and CG3
- Specific: CE2, CE3, CE4, CE5 y CE6

Non-presential activities

Students will conduct the non-presential activities requested by the teacher (memoirs, reports of practices, etc.) and they will deliver them on the specified date.

The competences to acquire from the presential activities will be:

- Specific: CE7

EVALUATION

La información está en un formato que no se puede convertir

REFERENCES

- Aballe M., J. López Ruiz, J.M. Badía y P. Adeva (eds.), Microscopía Electrónica de Barrido y Microanálisis por Rayos X, CSIC y Rueda, Madrid, 1996.
- Bermúdez J., Métodos de difracción de rayos X. Principios y aplicaciones, Pirámide, 1981.
- Goldstein J.I. (ed.), Scanning Electron Microscopy and X-Ray Microanalysis. A Text for Biologists, Materials Scientists, and Geologists, Plenum Press, 1981.
- Goodhew P.J. y F.J. Humphreys, Microscopy and Analysis, Taylor & Francis, 1988.

- Heinrich K.F.J., Electron Beam X-Ray Microanalysis, Wiley, New York, 1987.

- Klug H.P. y L.E. Alexander, X-Ray Diffraction Procedures for Polycrystalline and Amorphous Materials, Wiley, 1974.

- Wormald J., Métodos de difracción, Reverté, Barcelona, 1981.