VNIVERSITAT DE VALÈNCIA

Course Guide
42929 Advanced techniques in spectrometry and electroanalysis

COURSE DATA

DATA SUBJECT

Code: 42929
Name: Advanced techniques in spectrometry and electroanalysis
Cycle: Master's Degree
ECTS Credits: 4
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period

SUBJECT-MATTER

Degree	Subject-matter	Character

COORDINATION

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SUMMARY

Laboratory subject dedicated to learning work methodologies used in the use of advanced spectrometry techniques, as well as in the use of nanoscopic electroanalytical techniques or in the use of electrochemical sensors and impedance techniques.

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 -

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. Development of advanced functional materials for spectrometric Applications

Development of metal-organic frameworks and/or other porous materials for their use in analytical applications using spectrometry.

2. Interpretation and characterization of the properties of functional materials for use in combination with spectrometric methods

Development of analytical applications with advanced functional materials for the monitoring of substances in different matrices.

3. Nanoscopic electroanalytical techniques

Voltammetry with macro and microelectrodes.

4. Impedance techniques

Impedance techniques studies

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Total hours	0,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	12,00
Independent study and work	20,00
Preparation of lessons	8,00
Preparation for assessment activities	12,00
Resolution of case studies	8,00
Total hours	60,00

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

FIRST CALL

1- Along the sessions, focus in the resolution of practical assays, the assistance and participation of the students will be evaluated individually (by oral answers or by writing questions planned by the professor, by planning questions which its answer will be relevant for all the group). Also, these questions will include the design of working protocols, the selection of variables and the tools for the data treatment (*Verifica* competences CE2, CE3, CE5 and CE6).

The competences to evaluate: specifics: CE2, CE3, CE4, CE5 and CE6

WEIGHT 40 %

2.- An assessment of non-classroom-based activities (memories and/or reports of practices delivered) The reports performed by the students will include the main conclusions extracted from the laboratory work (working protocols, variable selection and data treatment; *Verifica* competences CE2, CE5, CE6 and CE7) and it will be done by couples to improve the group working (consensus decision making: *Verifica* competences CG1 and CE7)

The competences to evaluate: specifics: CE7

WEIGHT 30 %

3. -Written examinations (Based on the results of learning the content and on the specific objectives of each subject) The exam will consist in the resolution of questions and practical examples related to the studied techniques (*Verifica* competences: CE2, CE4, CE5 and CE6).

The competences to evaluate: specifics: CE2, CE4, CE5 i CE6

WEIGHT 30 %

The minimum grade obtained in each of evaluated parts must be equal to or greater than 4.5 in order to average between them.

The minimum overall grade to pass the course is 5.0.

SECOND CALL

The evaluation will be carried out in the same way as in the first call.

REFERENCES

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- I. Pacheco-Fernández, P. González-Hernández, J. Pasán, J.H. Ayala, V. Pino, The Rise of Metal-Organic Frameworks in Analytical Chemistry, Handb. Smart Mater. Anal. Chem. (2019) 463502.
- Y. Zhai, Q. Wang, H. Zhangsunm X. Sun, T. Bum Y. Kium W, Wang, Z. Xu, L. Wang, Europium-based metal-organic framework containing characteristic metal chains: A novel turn-on fluorescence sensor for simultaneous high-performance detection and removal of tetracycline, Sensors and Actuators B: Chemicals, 334 (2021) 129610.

- Doménech, A.; Doménech, M.T.; Costa, V. Electrochemical methods for archaeometry, conservation and restoration, Springer, Berlin, 2009.

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- Goldstein, J.I.; Newbury, D.E.; Echlin, P.; Joy, D.C.; Fioril, Ch.; Lifshin, E. Scanning Electros Microscopy and X-Ray Microanalysis. Plenum Press, Nueva York, 1984.

- Pingarrón, J.M.; Sánchez Batanero, P. Química electroanalítica: fundamentos y aplicaciones. Síntesis, Madrid, 2003.

- Tertian, R.; Claise, F. Principles of Quantitative X-Ray Fluorescence Analysis. Heyden, Londres, 1982