



IDENTIFYING DATA

Enhancement of Analytical Chemistry

| | | | | |
|---------------------|---|----------|------|------------|
| Subject | Enhancement of Analytical Chemistry | | | |
| Code | V11G201V01406 | | | |
| Study programme | Grado en Química | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 4th | 2nd |
| Teaching language | Spanish | | | |
| Department | | | | |
| Coordinator | Lavilla Beltrán, María Isela | | | |
| Lecturers | Lavilla Beltrán, María Isela | | | |
| E-mail | isela@uvigo.es | | | |
| Web | http://quimica.uvigo.es/gl/ | | | |
| General description | This subject provides students with knowledge about important and current aspects of analytical chemistry (e.g., bioanalytical techniques, automation and miniaturisation, sensors and chemometrics). Students will be able to complete their training and integrate the knowledge acquired in analytical chemistry, which will allow them to address problem-solving in areas of special interest (e.g., clinical, environmental and industrial fields). | | | |

Training and Learning Results

| | |
|------|---|
| Code | |
| A1 | Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study |
| A3 | Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues |
| B4 | Ability for analysis and synthesis |
| C30 | Ability to understand, interpret and adapt the advances in the field of Analytical Chemistry |
| D1 | Ability to solve problems |

Expected results from this subject

| Expected results from this subject | Training and Learning Results | | | |
|--|-------------------------------|----|-----|----|
| Recognize the main current trends in analytical chemistry. | | B4 | C30 | |
| Use and recognize different bioanalytical methodologies. | A1 | | C30 | |
| Describe and distinguish the different types of automatic analysis systems. | | B4 | C30 | |
| Understand the advantages and limitations of automation. | A3 | B4 | C30 | |
| To train students in the development of miniaturized analytical tools and their application. | A1 | | C30 | |
| Value the importance of the use of sensors to obtain fast and reliable analytical information. | A3 | | C30 | |
| Correctly apply different chemometric techniques to solve analytical problems. | A1 | | C30 | D1 |
| | A3 | | | |
| Acquire skills to approach an analytical problem in all its stages (from the selection of an appropriate analytical methodology, through the practical laboratory work, to the interpretation of results). | A1 | B4 | C30 | D1 |
| | A3 | | | |

Contents

| Topic | |
|----------------------|--|
| Topic 1. Immunoassay | Introduction. In vitro antigen-antibody reaction. Immunoassay techniques without marker. Immunoassay techniques with marker: generalities. Radioimmunoassay. Enzyme immunoassay. Fluoroimmunoassay. Luminoimmunoassay. |

| | |
|---|--|
| Topic 2. Enzymatic methods of analysis | Introduction. Enzymatic end-point methods: single-step methods and methods with coupled reactions. Enzyme kinetic methods: methods based on zero-order kinetics and methods based on one-order kinetics. |
| Topic 3. Determination of nucleic acids: Hybridization and PCR techniques | Introduction. Nucleic acid extraction and purification techniques. Hybridization assays: liquid phase, solid phase and in situ. Polymerase chain reaction: basics. Variants of classical PCR. |
| Topic 4. Automation and miniaturization | Introduction. Automation: generalities. Analyzers. Flow Injection Analysis (FIA). Sequential injection analysis (SIA). Miniaturization: fundamentals and approaches. |
| Topic 5. Chemical sensors and biosensors | Introduction. Recognition systems. Classification of chemical sensors and biosensors. Analytical characteristics of the sensors. Applications of interest. |
| Topic 6. Chemometrics | Introduction to chemometrics. Structure of hypothesis testing. Rejection of anomalous results. Comparison of analytical results: parametric and non-parametric tests. Control charts. Introduction to experimental design. |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|--------------------------|-------------|-----------------------------|-------------|
| Lecturing | 24 | 36 | 60 |
| Seminars | 12 | 24 | 36 |
| Laboratory practical | 14 | 10 | 24 |
| Objective questions exam | 2 | 10 | 12 |
| Objective questions exam | 0 | 18 | 18 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|----------------------|---|
| Lecturing | The lecturer will develop the contents of the programme based on the material provided to the student through Moovi. In the lecture sessions, the lecturer will present the fundamental aspects of the subject, which should be complemented by the recommended bibliography. |
| Seminars | The seminar classes will help to reinforce the learning of the subject matter explained during the lectures by solving numerical problems and/or theoretical-practical exercises. The lecturer will regularly propose different problems, exercises or questionnaires that will be solved individually by the student and delivered for evaluation. |
| Laboratory practical | Laboratory experiments will be carried out in 4 sessions of 3.5 hours each. Prior to each practical session, the student will be provided with supporting material in Moovi for the preparation of the experiments to be carried out. |

Personalized assistance

| Methodologies | Description |
|--------------------------|---|
| Lecturing | The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used. |
| Seminars | The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used. |
| Laboratory practical | The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used. |
| Tests | Description |
| Objective questions exam | The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used. |
| Objective questions exam | The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used. |

Assessment

| Description | Qualification | Training and Learning Results |
|-------------|---------------|-------------------------------|
| | | |

| | | | | | | |
|--------------------------|---|----|----------|----|-----|----|
| Seminars | For the evaluation of this activity, the teacher will propose the resolution and delivery by the student of some problems, exercises and/or questionnaires in seminar classes. | 5 | A1 A3 | B4 | C30 | D1 |
| Laboratory practical | The teacher will assess the experimental work carried out by the student in the laboratory sessions through observation and the delivery of the obtained results (laboratory report). | 15 | A1 A3 | B4 | C30 | D1 |
| | Attendance at laboratory sessions is compulsory. Absence from any laboratory session must be duly justified. | | | | | |
| Objective questions exam | There will be a first examination limited to approximately half of the subject. | 40 | A1 A3 | B4 | C30 | D1 |
| | This exam may consist of short answer questions, problems and multiple choice questions. | | | | | |
| | The fact of sitting the exam precludes the student from the grade "Not presented". | | | | | |
| | Students who obtain a minimum score of 5 out of 10 will not be examined again in the contents considered in the first examination. | | | | | |
| Objective questions exam | This final exam is compulsory. | 40 | A1 A3 | B4 | C30 | D1 |
| | Students who have passed the first part will take the second part of the syllabus. | | | | | |
| | This examination may consist of short answer questions, problems and/or multiple-choice questions. | | | | | |
| | The fact of sitting the exam precludes the student from the grade "Not presented". | | | | | |
| | Students who have not passed the first part will have to take the first part of the syllabus (40% final mark). | | | | | |

Other comments on the Evaluation

Second opportunity (July):

The marks obtained by the student during the course in the laboratory practicals and seminars will be retained (20 % of the grade).

Students will be able may do both exams.

The student who wishes may opt for the overall assessment.

Sources of information

Basic Bibliography

Paolo Ugo, Pietro Marafini, Marta Meneghello, **Bioanalytical chemistry. From biomolecular recognition to nanobiosensing**, Primera, De Gruyter, 2021

Miguel Valcárcel, Soledad Cárdenas, **Automatización y miniaturización en Química Analítica**, Primera, Springer, 2000

Florinel-Gabriel Bănică, **Chemical sensors and biosensors: Fundamentals and applications**, Primera, Wiley, 2012

Guillermo Ramis Ramos, María Celia García Álvarez-Coque, **Quimiometría**, Prmera, Síntesis, 2001

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Quality in Analytical Labs/V11G201V01407

Food, Agricultural and Environmental Analytical Chemistry/V11G201V01410

Subjects that it is recommended to have taken before

Biochemistry/V11G201V01201

Analytical Chemistry I: Principles of Analytical Chemistry/V11G201V01202

Analytical Chemistry II: Optical Methods of Analysis/V11G201V01207

Analytical Chemistry III: Electroanalytical Methods and Separations/V11G201V01302

Analytical Chemistry IV: Chromatographic and Affine Methods/V11G201V01306

