# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 36461 |
| **Name** | Quality and Risk Prevention |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2021 - 2022 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1110 - Degree in Chemistry | Faculty of Chemistry | 4 | Second term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 1110 - Degree in Chemistry | 14 - Analytic Chemistry Applied | Optional |

**Coordination**

| Name | Department |
|---|---|
| SAGRADO VIVES, SALVADOR | 310 - Analytical Chemistry |

# SUMMARY

The subject *Quality and Risk Prevention* is included in the area *Applied Analytical Chemistry*, along with threeother subjects: *Industrial Chemical Analysis*, *Environmental Analytical Chemistry*and the *Applied Instrumental Analysis Laboratory*. They have in common the approach to scientific-technical, applied and practical aspects that future chemists, and in particular analytical chemists, may need in their future professional, training or research activity, based on the knowledge acquired in the previous semesters. In addition, they will also serve as a basis for possible postgraduate and master's courses, such as the Master in Occupational Risk Prevention or the Master in Experimental Techniques in Chemistry.

Quality and risk prevention are current requirements in many of the areas mentioned before. For example, from an analytical point of view, assay laboratories, carrying out chemical analysis, must adopt accreditation systems to survive in an increasingly globalised market, to fit the demands of an increasingly technically formed customer. As all companies (industries), they must be respectful with the environment and adopt risk prevention standards, which ensure the safety and hygiene, largely related to the development of their activity.

The course begins with the development ofthe general concept of chemical risk in the workplace and the environment, and then focuses on chemical agents (occupational health and safety, emissions, dumping, waste), with emphasis on how to evaluate them and on control tools. It then deals with the general concept of quality and quality systems (standards), and then focuses on the accreditation of testing laboratories. Finally, technical aspects of accreditation are addressed, paying special attention to method validation, among other accreditation requirements.

General objectives of the course are:

• That the student acquires an overview of the various elements and approaches, but also laws and regulations that have an impact on aspects of quality, environment and risk prevention, studying in depth the impact of pollutants, and on the accreditation technical requirements in a modern testing laboratory.

• That the student acquires knowledge of the different roles and responsibilities that the chemist may have to develop in the chemical industry and in the laboratory, linked to the above-mentioned aspects.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

In order to be able to address successfully the subject, it is suitable that the student has acquired knowledge during the study of the subjects of Analytic Chemistry and related laboratories, particularly: the problem and the analytical process, significant features of analytical methodologies, main analytical and separation techniques and statistics applied to chemical analysis.

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 1110 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Solve problems effectively.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.

- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Learn autonomously.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Show knowledge of the metrology of chemical processes including quality management.
- Handle chemicals safely.
- Evaluate the risks in the use of chemicals and laboratory procedures.
- Develop sustainable and environmentally friendly methods.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

## LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The previous section includes the competences contained in the document VERIFICA. This course deals with part of the learning results of the subject "Applied Analytical Chemistry" which allows acquiring specific knowledge of Chemistry as well as cognitive skills and competences and general competences recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning results acquired in the subject "Quality and Risk Prevention" related to the competencies of the degree in Chemistry.

| **SPECIFIC KNOWLEDGE OF CHEMISTRY** | |
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| **The learning process should allow the degree graduates to demonstrate:** | |
| | **Competences of the subject “Quality and Risk Prevention” that contemplate the learning outcomes EUROBACHELOR®** |

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|---|---|
| The principles and procedures used in chemical analysis and the characterisation of chemical compounds. | Show knowledge of the metrology of chemical processes including quality management..(CE10)<br><br>Develop sustainable and environmentally friendly methods.(CE25) |
| **COMPETENCES AND COGNITIVE SKILLS** | |
| **The learning process should allow the degree graduates to demonstrate:** | |
| | **Competences of the subject "Quality and Risk Prevention" that contemplate the learning outcomes EUROBACHELOR®** |
| Competences for the evaluation, interpretation and synthesis of information and chemical data. | Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them..(CE20). |
| Ability to calculate and process data, related to information and chemistry data. | Solve qualitative and quantitative problems following previously developed models..(CE14).<br><br>Recognise and analyse new problems and plan strategies to solve them..(CE15). |

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| **COMPETENCES AND COGNITIVE SKILLS RELATED TO THE PRACTICE OF CHEMISTRY** | |
| Ability to perform risk assessments of the use of chemical substances and laboratory procedures. | Develop sustainable and environmentally friendly methods.(CE25).<br><br>Evaluate the risks in the use of chemicals and laboratory procedures..(CE21). |
| **GENERAL COMPETENCES** | |
| **The learning process should allow the degree graduates to demonstrate:** | |
| | **Competences of the subject "Quality and Risk Prevention"that contemplate the learning outcomes EUROBACHELOR®** |
| Calculation and arithmetic capabilities, including aspects such as analysis error, estimates of orders of magnitude, and correct use of the units. | Develop capacity for analysis, synthesis and critical thinking.. (CG1).<br><br>Show inductive and deductive reasoning ability..(CG2).<br><br>Solve problems effectively..CG4). |
| Competences in information management, in relation to primary and secondary sources, including information retrieval through on-line searches. | Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using |

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| | information technology, as appropriate..(CG6).<br><br>Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2). |
| Ability to adapt to new situations and make decisions. | Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration..(CB3). |
| Skills related to information technology such as word processing, spreadsheet, recording and storage of data, internet use related to the subjects. | Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6).<br><br>Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2). |
| Interpersonal skills to interact with other people and get involved in team work. | Demonstrate ability to work in teams both in interdisciplinary teams |

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| | and in an international context..(CG5).<br><br>Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). |
| Study skills necessary for professional development. These will include the ability to work autonomously. | Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3).<br><br>Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5).<br><br>Demonstrate the ability to adapt to new situations..(CG9).<br><br>Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.(CB5). |
| Ethical commitment to the European Code of Conduct:<br><br>http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf | Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.(CG10). |

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| | Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7).<br><br>Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration. (CB3). |

These learning results must allow the student to be able to:

1. To know the theoretical and practical aspects necessary to plan, apply and manage the most appropriate analytical methodology to tackle problems of an industrial and environmental nature.
2. Understand and use bibliographic and technical information related to analytical chemical processes.
3. Make rigorous decisions
4. Knowing the tools and principles of sustainable chemistry
5. Knowing the chemical parameters of environmental quality
6. Critical reasoning.
7. Demonstrate ability to manage information.
8. Demonstrate ethical commitment and a gender perspective.
9. To know the theoretical and practical aspects necessary to approach the quality systems of a chemical company.
10. To know the necessary tools to carry out an audit in a chemical company.
11. Assessing the risks in the use of chemical substances and procedures in the chemical company.

## DESCRIPTION OF CONTENTS

### 1. Chemical risk: evaluation and control.

Chemical risk, evaluation and control. Legislation on the prevention of occupational hazards. Safety and industrial hygiene. Classification of chemicals. Health risks from exposure to chemical agents. REACH regulations (Registration, evaluation, authorization and restriction of chemical substances and mixtures) and CLP (classification, labeling and packaging of chemical substances and mixtures). Chemical risk assessment: exposure limit values and exposure indices, simplified methodologies. Control of chemical

risk: actions on the focus, on the environment and on the individual. Fires, explosive atmospheres and confined spaces. Emergency and self-protection plans.

**2. Environmental protection: emissions, discharges and residues.**

Environmental Protection: emissions, discharges and residues. Environmental legislation: prevention and control of pollution. Control of air emissions. Control of discharges: urban and industrial wastewater. Management and treatment of residues. Integrated Prevention and Pollution Control: Integrated Environmental Authorisation (AAI) and Best Available Techniques (MTD, BAT). Environmental risk assessment. Environmental management systems.

**3. Quality**

Quality. Concept of quality. Quality management and technical quality. Quality systems in the chemical industry, control laboratories and testing laboratory. Case study: documentation, audits, structure and computerized management of a laboratory.

**4. Accreditation**

Accreditation. Concepts of accreditation, certification and homologation. The national accreditation entity. Case study: The norm of accreditation for testing laboratories and the accreditation process

**5. Internal Method Validation**

Internal Method Validation. Concept of validation. Internal and external validation. Process of internal method validation. Features, requirements and validation criteria. Validation strategies. Case studies: validation reports.

**6. Internal Quality Assurance**

Internal Quality Assurance. Standardized aspects. Auditable aspects. Repetition of samples. Method Verification. Quality control and control charts. Case studies.

**7. External Quality Assurance: Proficiency testing**

External Quality Assurance: Proficiency testing. Concepts: assigned values. Process. Case study.

**8. Estimation of Uncertainty**

Estimation of Uncertainty. Concept of uncertainty. Uncertainty of the result of chemical assays. Standardized aspects for test reports. Sources of uncertainty. Case studies: approaches and trends for the estimation.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 51,00 | 100 |
| Tutorials | 9,00 | 100 |
| Attendance at events and external activities | 2,00 | 0 |
| Development of group work | 8,00 | 0 |
| Development of individual work | 8,00 | 0 |
| Study and independent work | 16,00 | 0 |
| Readings supplementary material | 12,00 | 0 |
| Preparation of evaluation activities | 12,00 | 0 |
| Preparing lectures | 12,00 | 0 |
| Preparation of practical classes and problem | 10,00 | 0 |
| Resolution of case studies | 9,00 | 0 |
| Resolution of online questionnaires | 1,00 | 0 |
| **TOTAL** | **150,00** | |

## TEACHING METHODOLOGY

This course consists of **theory**, **practice** and **case study** classes, as well as **group tutorials** and **seminars**.

In **theory classes**, an introductory overview of the aspects of quality and risk prevention, at the conceptual level, will be addressed, emphasizing the technical component. In the **practice classes**, the foundations for the resolution of questions and problems related to the technical aspects of the subject will be provided. Also, general **case studies** that will be used to work the overall treated aspects, and at the same time, to guide the evaluation (like exam models) will be addressed.

In the **group tutorials**, case studies presented will be resolved, serving to evaluate the ability of the student to its resolution. These classes will also serve to raise and resolve doubts arising from the student in relation to issues and problems.

The **seminars** will serve to work the practical point of view of the subjects and to gain skills on them, through discussions on reports submitted by students: visit to an accredited laboratory, presentation and discussion of case studies (e.g. Labels and Material safety data sheets, risk prevention scenarios and technical quality) and information recovery on Qualimetrics (statistics) involved in decision-making.

In addition, throughout the course students will solve various tasks, critical reports and standardized records raised by the teacher, which will contribute to the evaluation process.

## EVALUATION

The assessment of student learning will take into account all the points listed in the section 'Methodology' of this teaching guide.

FIRST CALL

Final Rating: the evaluation will be based on a written examination, to be carried out on the dates established by the CAT, and on continuous evaluation, corresponding to the carrying out of activities in the seminars, activities proposed in the group tutorials and other work proposed during the course to be carried out inside or outside the classroom. The qualification that comes from the evaluable activities carried out inside the classroom or in group tutorials will NOT be recoverable by means of the accomplishment of another type of tests. In the rest of the activities, the delivery within the established period will be an evaluation criterion. The weighting to be carried out will be:

Final Rating:

| Activities in seminars and other proposed tasks | Activities proposed in the group tutorials | Exam |
|---|---|---|
| **15%** | **20%** | **65%** |

The minimum score for exam must be equal to or greater than **4.5**. The global minimum score to pass the course is **5.0**.

SECOND CALL

The second call will consist of an exam and the qualification is obtained by applying the same criteria as in the first call, with the note obtained on first call for seminar and tutorials.

## REFERENCES

### Basic

- SAGRADO, S. y otros. Manual práctico de calidad en los laboratorios. Enfoque ISO 17025. 2ª edición, AENOR, Madrid, 2005
- Entidad nacional de acreditación (ENAC). www.enac.es
- Asociación española de normalización y certificación. AENOR. www.aenor.es
- EURACHEM. http://www.eurachem.org/
- AOAC international. http://www.aoac.org/
- Riesgo químico: sistemática para la evaluación higiénica. J. Aguilar Franco y otros técnicos del Centro Nacional de Nuevas Tecnologías, INSHT. INSHT. Madrid. 2010. http://cort.as/-JCxS
- Instituto Nacional de Seguridad, Salud y Bienestar en el trabajo. INSSBT. http://www.insht.es/portal/site/Insht/
- GRAU RÍOS, M., GRAU SÁENZ, M. Riesgos ambientales en la industria. UNED, Madrid, 2006.

### Additional

- REVOIL, G. Calidad en los laboratorios de calibraciones y ensayos. Mejora de los procesos. AENOR, Madrid, 2003
- COMPAÑÓ, R., RÍOS, A. Garantía de calidad en los laboratorios de análisis químicos. Mejora de los procesos. Síntesis, Madrid, 2002
- Aula Virtual, Recursos: Materiales relacionados con la calidad y la prevención de riesgos.
- Guía para la validación, control de calidad y expresión de la incertidumbre relacionada con los métodos químicos volumétricos. http://www.uv.es/gammmm/
- Guía técnica para la evaluación y prevención de los riesgos relacionados con agentes químicos. R.D. 374/2001. Octubre 2013. INSHT. Madrid. http://cort.as/-JCyw

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

**Contents**

*1.- The contents initially indicated in the teaching guide are maintained.*

**Workload and temporary teaching planning**

Regarding the workload:

*1.- The different activities described in the Teaching Guide are maintained with the intended dedication.*

Regarding the temporary teaching planning:

*1.- The material to follow the theory/tutoring/classroom-seminar classes allows to continue the temporary teaching planning both in days and schedule, whether the teaching is face-to-face in the classroom or not.*

**Teaching Methodology**

Theory subjects:

*Situation of minimal attendance*: In theory classes and tutorials the occupation will be, at most, 30% of their usual occupation. Teaching will be online. Students who have a laboratory session before or after theory classes, and the time to travel is longer than the time established in the schedules, will be able to follow the class in person in the classroom assigned in the schedules. When there are students in this situation, classes will be taught by synchronous videoconference in the group classroom.

*Maximum face-to-face situation:* In theory classes and tutorials, the occupation will respect the sanitary restrictions that limit the capacity of the classrooms. Depending on the capacity of the classroom and the number of students enrolled, it may be necessary that part of the students have to follow the classes synchronously. If this situation arises, the students will attend the group classroom in weekly rotating shifts (preferably in alphabetical order), so as to ensure that the percentage of attendance of all the students enrolled in the subject is the same.

*Confinement situation:* If for health reasons it is not possible to continue with hybrid teaching, totally or partially affecting the classes of the subject, these will be replaced by synchronous non-face-to-face sessions following the established schedules and using the virtual classroom tools.

The methodology used for non-face-to-face classes shall be:

1. Synchronously using virtual classroom tools (preferably Teams)

2. Asynchronously using presentations with audio narration or other virtual classroom tools

3. Resolution of exercises and questionnaires

4. Material facilitated through virtual classroom

*In all subjects*

*If there is a closure of the facilities for health reasons that totally or partially affects the classes of the course, they will be replaced by non-face-to-face sessions following the established schedules and using the tools of the virtual classroom.*

*In the case of homebound students due to the COVID, they will be assured of on-line teaching through the tools of the virtual classroom (preferably Teams)*

**Evaluation**

*1. The possibility of exam-only evaluation is eliminated.*

*2. The evaluation system described in the Teaching Guide of the subject in which the various evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.*

*If there is a closure of the facilities for health reasons affecting the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the University of Valencia. The contribution of each evaluable activity to the final grade of the subject will remain unchanged, as set out in this guide.*

**References**

*The literature recommended in the Teaching Guide is maintained since it is accessible, and it is complemented by notes, slides and problems uploaded to the Virtual Classroom as material of the course.*