

COURSE: INTEGRATION AND ANALYTICAL SPECIALIZATION LABORATORY

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in Analytical Chemistry

Page 1 of 6

GENERAL FEATURES *

Type: Basic Training Compulsory Elective

Master's thesis work, Practicum

Duration: Semester

Semester / s: 2

Number of ECTS credits: 5

Language / s: English, Spanish, Catalan

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION (The meaning of the course in relation to the program. Between 100 and 200 words.)

In this subject advanced instrumental analysis techniques will be explored: structural determination, electrochemical techniques, spectrophotometric techniques and chromatographic techniques.

The objective of the subject is to provide the student with knowledge for the application of these techniques to the quantitative / qualitative analysis of samples and the instrumentation required to perform the corresponding assays. It is also intended to provide students with knowledge of the latest advances in these techniques and methodology that enable them to apply such methodologies in their professional lives and to judge critically the obtained results. Finally, solid and liquid samples will be analyzed using these analytical techniques.

COMPETENCES (Of course you put in relation to the skills pre-assigned in the field.)

Basic competences

- CB6 - Have and understand knowledge which provides the ground or opportunity to be innovative in the development and/or application of ideas, often in a research context
- CB7 - Apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
- CB8 - Integrate knowledge and deal with the complexity of formulating judgments based on information which, being incomplete or limited, includes reflections on social and ethical responsibilities related to the application of their knowledge and judgments
- CB9 - Communicate conclusions, and the reasons that sustain them, to specialized and non-specialized audiences in a clear and unambiguous way.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

**COURSE: INTEGRATION AND ANALYTICAL
SPECIALIZATION LABORATORY**

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in
Analytical Chemistry

Page 2 of 6

Specific competences

- E14 - Ability to interpret the analytical results obtained in environmental samples (air, water, soil, sediments, waste, ...) and of pollutants detected in these samples
- E16 - Ability to interpret the analytical results obtained in pharmaceutical samples (raw materials, formulated products, active pharmaceutical ingredients, excipients) and in the determination of impurities, enantiomers and degradation products in these samples
- E18 - Ability to interpret the analytical results obtained in food samples (composition and functional properties) as well as and in the identification and quantification of impurities, foreign substances and residues in these samples.
- E20 - Ability to interpret the analytical results obtained in samples of raw materials, metals, polymers, ceramics and formulated products obtained with general analytical techniques or specific for these types of samples.

Transversal competences

- T1 - Ability to communicate in English and use English as a working language
- T3 - Ability to assess the impact of the use of chemistry in the sustainable development of the society

PREREQUISITES * (Modules, materials, disciplines or expertise needed to track the subject. Contain subjects that must have been completed can be made.)

Applicants to the Master's Degree Program in possession of a degree or bachelor's degree in Chemistry do not need bridging courses. Applicants in possession of other degrees must previously studied subjects that included contents of Instrumental Analysis, Structural Determination (including Mass Spectrometry) and Statistics. If not, bridging courses will be required.

CONTENTS (Sections that make up the syllabus, to a second level of detail.)

1. SCIENTIFIC SEARCH, DOCUMENTATION AND REGULATORY FRAMEWORK (SPECIFICATIONS, ANALYTICAL METHODS, MAXIMUM LEVELS ALLOWED IN LEGISLATION, ETC.)
2. DETERMINATION OF THE CHARACTERISTIC PARAMETERS OF EACH OF THE DIFFERENT SAMPLES ANALYZED.
3. APPLICATION OF THE DIFFERENT EXPERIMENTAL TECHNIQUES STUDIED.
4. ANALYSIS AND INTERPRETATION OF THE RESULTS OBTAINED.
5. WRITING AND ORAL PRESENTATION OF THE DEVELOPED WORK.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

**COURSE: INTEGRATION AND ANALYTICAL
SPECIALIZATION LABORATORY**

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in Analytical Chemistry

Page 3 of 6

METHODOLOGY

TRAINING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and skills.)

Training Activities	ECTS	Competences
Sessions of exposition of concepts	0.37	E2, E4, E6, E8 CG2
Sessions solving exercises, problems and cases	-	
Seminars	0.19	E2, E4, E6, E8 CG2
Practical work / laboratory	4.1	E2, E4, E6, E8 CG2
Presentations	0.19	E2, E4, E6, E8 CG2
Activities of personal study by students	-	
Evaluation activities (exams, monitoring controls ...)	0.15	E2, E4, E6, E8 CG2
TOTAL	5	

TEACHING METHODOLOGY (Justifying the teaching methods used in relation to the competences and contents of the course. Between 100 and 200 words.)

Students will perform a set of different laboratory demonstrations in groups of 2-3. Each group is provided with samples of different industrial sectors. The first step that the student must perform is to be conveniently documented on the specifications, analytical methods, techniques and legal framework related to each sample matrix. The student must perform all assays within the established timeline, which is available online.

All experimental results and observations must be annotated in the Laboratory Notebook. The Laboratory Notebook should be available to the laboratory Professor and will be graded.

After completing all analysis of the sample, students must submit a report describing the goals and main results obtained. All data must be compared with bibliographic information.

Each student must perform an oral presentation of the results and conclusions of each sample/matrix.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

COURSE: INTEGRATION AND ANALYTICAL SPECIALIZATION LABORATORY

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in Analytical Chemistry

Page 4 of 6

EVALUATION

ASSESSMENT SYSTEM * (Complete the table relating evaluation methods, competences and weight in the course grade.)

Evaluation Methods	%	Competences
Final Exam	-	
Monitoring activities	15	E2, E4, E6, E8, CG2
Projects and presentations	30	E2, E4, E6, E8, CG2
Practical work / laboratory	50	E2, E4, E6, E8, CG2
Participation	5	E2, E4, E6, E8, CG2

LEARNING OUTCOMES (Explanation of the embodiments that allow the student skills assessment, relating them to the skills and methods of assessment.)

- The student must demonstrate the knowledge of the main sampling methods of environmental, agri-food, pharmaceutical and industrial matrices. (E14, E16, E18, E20)
- The student must demonstrate the knowledge of the main analytical methods for the determination of chemical compounds in environmental, agri-food, pharmaceutical and industrial matrices. (E14, E16, E18, E20)
- The student must demonstrate the knowledge of specific analytical methods for the determination of chemical compounds in environmental, agri-food, pharmaceutical and industrial matrices. (E14, E16, E18, E20)
- The student must demonstrate their ability to interpret the results obtained in the determination of chemical compounds in environmental, agri-food, pharmaceutical and industrial matrices. (E14, E16, E18, E20, T3)
- The student must be able to communicate effectively both orally and in writing, to communicate in English and to use English as a working language, and to work in a multidisciplinary environment individually or as a member of a team. (T1, CG1)

QUALIFICATION (Explanation of the computer system of the course grade.)

The grade of this course is obtained:

Monitoring activities	15%
Projects and presentations	30%
Practical work / laboratory	50%
Participation	5%

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

COURSE: INTEGRATION AND ANALYTICAL SPECIALIZATION LABORATORY

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in Analytical Chemistry

Page 5 of 6

- **Monitoring activities** include works (exercises, problems and cases) that perform and deliver the students during the course.
- Students do group **Projects** of 2-3 people. Some of these works include presenting it to other peers.
- The **practical work / laboratory** includes all reports of the laboratory demonstrations performed.

The grade of the **practical work / laboratory** must be equal or higher than to 4 to be able to pass the course.

- The **participation** includes attendance, initiative and the attitude shown by the student in relation to the teacher and their peers.

ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competence and the relevant evaluation methods.)

All competences will be evaluated using the final grade of the course.

BIBLIOGRAPHY (Recommended and accessible to students.)

- F. Burriel, F. Lucena, S. Arribas, J. Hernandez, *Química Analítica Cualitativa*, Editorial Paraninfo, 2002 ISBN: 84-9732-140-5.
- D. A. Skoog, D.M. West, F. J. Holler (1996) *Fundamentos de Química Analítica*, 4 ed., Barcelona: Ed. Reverté.
- American Chemical Society, *Reagents Chemicals: American Chemical Society specifications*, official from January 1, 2000, 9th edition, Oxford University Press, New York. (<http://pubs.acs.org/reagents/10/search.html>)
- European Pharmacopoeia 5.0 (15 June 2004), 5th edition, Strasbourg: Ed. Council of Europa.
- USP 28: The United States Pharmacopoeia/ NF 23: The National Formulary (2004) official from January 1, 2005, Rockville: Ed. The United States Pharmacopoeia Convention, Inc.
- Food Chemicals Codex (1996), 4th edition, effective July 1, 1996, Washington, D.C.: Ed. National Academy Press.
- *Standard Methods for the Examination of Water and Wastewater* (1998). EE.UU.: Ed: APHA-AWWA-WPCF
- *Metodos Oficiales de Análisis* (1993). Madrid: Ed. Secretaria General Técnica Ministerio de Agricultura, Pesca y Alimentación.
- Normas UNE
- Normas DIN
- Annual Book of ASTM Standards (1992). USA: Ed. ASTM.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

**COURSE: INTEGRATION AND ANALYTICAL
SPECIALIZATION LABORATORY**

SUBJECT: Advanced Analytical Chemistry

MODULE: SPECIFIC

PROGRAM: University Master's Degree in
Analytical Chemistry

Page 6 of 6

- Official Methods of Analysis of AOAC International, 17th edition current through 2nd revision (2003) (cd-rom).
- Decreto 1/1997, de 7 de enero sobre la disposición de rechazo en depósitos controlados (DOGC, núm. 2307, 13 de enero de 1997).
- Orden de 1 de junio, sobre la acreditación de laboratorios para la determinación de las características de los residuos (DOGC, núm. 2069, 30 de junio de 1995).
- *Legislación alimentaria de España: clasificada por alimentos*, Madrid: Ed. EYPASA

DOCUMENT HISTORY

PREVIOUS CHANGES (You set the date and author / s, the most recent first)

17th September 2014, Sergi Colominas

1st July 2015, Sergi Colominas

LAST REVISION (Indicate date and author / s.)

21st July 2016, Sergi Colominas