

COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **QUÍMICA ANALÍTICA APLICADA**

Code: 100473

Degree/Master: **GRADO DE QUÍMICA**

Year: 3

Name of the module to which it belongs: APLICADO

Field: QUÍMICA (OPTATIVA 1)

Character: OPTATIVA

Duration: SECOND TERM

ECTS Credits: 6.0

Classroom hours: 60

Face-to-face classroom percentage: 40.0%

Study hours: 90

Online platform: <http://moodle.uco.es/moodlemap/>

LECTURER INFORMATION

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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

The student must have approved the block of 60 credits corresponding to the basic subjects and at least 30 credits of compulsory subjects.

Recommendations

English level: minimum B2

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INTENDED LEARNING OUTCOMES

CB4	Being familiar with a foreign language
CB5	Demonstrating the ability to manage data, generate information and produce knowledge
CB6	Problem solving
CB9	Developing critical thinking
CB11	Showing awareness of environmental topics
CE1	To understand the key elements of chemical terminology, nomenclature, units and agreements.
CE16	The study of instrumental techniques and their applications.
CE19	To be able to organise, manage and carry out tasks in a chemical laboratory and in complex industrial facilities where chemical processes are carried out. Similarly, the ability to design methodologies for tasks.
CE23	The ability to evaluate, interpret and summarise data and information on Chemistry.
CE24	The ability to recognise and carry out good practices when carrying out scientific work.
CE28	To give students the skills to be able to carry out standard laboratory procedures involved in analytical tasks regarding organic and inorganic systems.
CE31	To interpret data based on observations in the laboratory in terms of their importance and supporting theories. .

OBJECTIVES

Aims

To apply the theoretical and practical knowledge acquired in the subjects previously taught in Analytical Chemistry to the analysis of real samples. To acquire the necessary knowledge in order to correctly address the handling and treatment of samples, under clinical analysis, of foodstuffs, environmental and toxicological. To select the most adequate techniques of separation and determination, according to the type of analysis. To resolve analytical problems that may arise in the control or research laboratories.

CONTENT

1. Theory contents

Theory contents

UNIT I. CLINICAL ANALYSIS

1. Introduction. Automatization of the clinical laboratory. Types of samples. Handling and processing of the samples.
2. Enzymatic and immunochemical analysis. Determination of substrates, enzymes, activators, inhibitors, antigens and antibodies in clinical samples.
3. Determination of inorganic species, carbohydrates, proteins and lipids in clinical samples.

UNIT II. FOODSTUFF ANALYSIS

4. Introduction. Control of food quality. Types of foodstuff. The Spanish Foodstuff Code. Handling and treatment of samples. General determinations: humidity, relative humidity in the balance, ashes, acidity and pH.
5. Determination of majority components. Proteins: characterization, separation, determination of total proteins, determination of proteins in milk, meat and cereals. Carbohydrates: methods of separation and determination. Lipids: total lipids, indices of fatty materials, instrumental methods.
6. Determination of minority components. Inorganic species: treatment of samples and determining methods.



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Determination of decomposed volatiles responsible for food aroma (taste/smell).

7. Determination of food additives: coloring, preservatives, antioxidants, flavoring and additive mixtures. Advanced analytical methods in the detection of foodstuff fraud.

UNIT III. ENVIRONMENTAL ANALYSIS

8. Pollution in the atmosphere. Introduction. Sample handling. General determining methodologies. Determination of inorganic species in the atmosphere: carbon, nitrogen and sulphur compounds, oxidants, metallic traces and particles. Determination of organic species in the atmosphere: hydrocarbons, carboxylic acids, carbonyl compounds and halogenated compounds.

9. Pollution in water. Introduction. Sample handling. Physical characterization and physiochemical determinations. General determinations: salinity, hardness, acidity, alkalinity. Determination of inorganic species in water: gases, metallic species, inorganic anions. Determination of organic species in water: total organic material, chemical and biochemical demand of oxygen, hydrocarbons, phenols, pesticides and surfactants.

10. Pollution in soils. Introduction. Sample handling. Determination of inorganic species: compounds of nitrogen and phosphorous, salts and trace elements. Determination of organic species: pesticides, hydrocarbons, humic substances.

UNIT IV. TOXICOLOGICAL ANALYSIS

11. Introduction. Problems with toxicological analysis. Screening and confirming methods.

12. Determination of pharmaceuticals and substance abuse. Determination of food toxicity. Determination of toxicity in the atmosphere.

2. Practical contents

SEMINARS

Seminar 1. Preparation of work to be done in the chemical analysis laboratory.

Seminar 2. Theoretical-practical questions about enzymatic and immunochemical analysis and about the determination of routine clinical parameters.

Seminar 3. Development of analytical methods to resolve agro-food problems in research and innovation projects. The experience of pre-commercial public purchasing at Córdoba University.

Seminar 4. Visit to an agro-food laboratory. Theoretical-practical questions about food analysis. General determinations of majority, minority and food additive components.

Seminar 5. Theoretical-practical questions about atmosphere and water analysis. Student exhibition of work done in the laboratory.

Seminar 6. Theoretical-practical questions about soil and toxicological analysis. Student exhibition of work done in the laboratory.

LABORATORY PRACTICE

Practice 1: Development of an analytical method using photometry

Practice 2: Development of an analytical method using GC

Practice 3: Development of an analytical method using HPLC

METHODOLOGY

General clarifications on the methodology (optional)

The methodology for **full-time students** will be the following:

MASTER CLASSES. The teacher will explain the content specified in the theory syllabus. Students will have access to the graphic material used in the virtual classroom.

SEMINARS. These will include discussion and resolution of theoretical-practical questions arising from the content of the syllabus and from the work done in the laboratory. Students will be informed in advance about these questions in order to be able to study their resolution and



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actively participate in these sessions. They will also present one of the practices carried out in the laboratory in an oral session.

LABORATORY PRACTICE. Three practices will be done on the analysis of foodstuffs, clinical and environmental. Before each practice session, students will send to the practice teacher the methodology and work plan to be carried out in the lab in order to resolve the analytical problem selected. The teacher will revise and correct the plan designed by the students before going to the laboratory. After the practice work students will hand in a report explaining the results obtained.

Methodological adaptations for part-time students and students with disabilities and special educational needs

Methodology and methodological adaptations for part-time students will be carried out following the regulations of the center and taking into account the characteristics in each case.

The methodological strategies and evaluation system contemplated in this Teaching Guide will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.

Face-to-face activities

Activity	Large group	Medium group	Small group	Total
<i>Assessment activities</i>	3	-	-	3
<i>Lab practice</i>	-	-	18	18
<i>Lectures</i>	30	-	-	30
<i>Seminar</i>	-	9	-	9
Total hours:	33	9	18	60

Off-site activities

Activity	Total
<i>Exercises</i>	10
<i>Group work</i>	10
<i>Information search</i>	10
<i>Self-study</i>	60
Total hours	90

WORK MATERIALS FOR STUDENTS

Case studies
Dossier
Exercises and activities
Placement booklet

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EVALUATION

Intended learnig	Exams	Laboratory Practice	Oral Presentation
CB11		X	
CB4	X	X	X
CB5		X	X
CB6		X	X
CB9	X	X	X
CE1	X	X	
CE16	X	X	X
CE19		X	X
CE23	X	X	X
CE24		X	X
CE28		X	X
CE31		X	X
Total (100%)	50%	40%	10%
Minimum grade	5	5	5

(*)Minimum grade necessary to pass the course

Method of assessment of attendance:

The attendance to the Seminars and Laboratory practices will be compulsory, that is to say, their lack of attendance must be 0%.

REPEATERS: Students who repeat the subject will not be obliged to repeat practice classes, but they are recommended to attend theoretical classes and seminars.

General clarifications on instruments for evaluation:

A final exam will be given which will account for 50% of the final mark. This exam will consist of 20-25 short-answer questions about the content of the master classes and the seminars. Students must attain a minimum mark of 5.0 (over 10) in the final exam to pass and marks obtained during practice and in the seminars will be considered. Three partial exams will also be given, of an eliminatory character.

The students' work in the practice sessions (40%) and in the seminars (10%) will account for 50% of the final mark.

Repeaters: attendance of students repeating the different activities of the subject will be voluntary. If they choose to do so, they will be evaluated in the same way as freshly- enrolled students. Otherwise, the mark corresponding to practical classes, seminars and group assignments will be that obtained by the student during the course already completed.

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Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

Evaluation of part-time students will be made according to the centre's rules and regulations and considering the characteristics of each case.

The methodological strategies and the evaluation system contemplated in this Teaching Guide will be adapted in accordance with the individual case for students with disabilities and special educational needs where required.

Qualifying criteria for obtaining honors:

According to article 80.3 of the Academic Regulations of the University of Cordoba, the

BIBLIOGRAPHY

1. Basic Bibliography

- Tietz Fundamentals of Clinical Chemistry. C.A. Burtis y E.R. Ashwood (Eds.) Saunders Company, Philadelphia, 2001.
- Food Chemistry. H.D. Belitz, W. Grosch y P. Schieberle. Springer, Berlín, 2004.
- Instrumental Methods in Food Analysis, J.R.L. Paré y J.M.R. Belanger. Elsevier, Amsterdam, 1997.
- Environmental Analytical Chemistry. D. Pérez Bendito y S. Rubio Bravo, Elsevier, 1999.
- Environmental Analysis. Techniques, Applications and Quality Assurance. D. Barceló (Ed.) Elsevier, Amsterdam, 1993.
- Analytical Aspects of Drug Testing, D.G. Deutsch. John Wiley and Sons, New York, 1989

2. Further reading

None

COORDINATION CRITERIA

Common evaluation criteria

Tasks performance

SCHEDULE

Period	Assessment activities	Lab practice	Lectures	Seminar
1# Week	0,0	0,0	2,0	0,0
2# Week	0,0	0,0	2,0	0,0
3# Week	0,0	0,0	2,0	1,5
4# Week	0,0	0,0	2,0	0,0
5# Week	0,0	0,0	2,0	1,5
6# Week	0,0	0,0	2,0	0,0
7# Week	0,0	0,0	2,0	1,5

COURSE DESCRIPTION

Period	Assessment activities	Lab practice	Lectures	Seminar
8# Week	0,0	6,0	2,0	0,0
9# Week	0,0	0,0	2,0	1,5
10# Week	0,0	6,0	2,0	0,0
11# Week	0,0	0,0	2,0	0,0
12# Week	0,0	6,0	2,0	0,0
13# Week	0,0	0,0	3,0	1,5
14# Week	3,0	0,0	3,0	1,5
Total hours:	3,0	18,0	30,0	9,0

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.

CONTINGENCY PLAN: CASE SCENARIO A

Case scenario A will correspond to a diminished on-site academic activity due to social distancing measures affecting the permitted capacity of classrooms.

METHODOLOGY

General clarifications on the methodology on case scenario A

A multimodal (hybrid) teaching system will be adopted, combining both on-site and remote classes via videoconference (synchronous) that will be held in the timetable approved by the corresponding Faculty or School. The time distribution of teaching activities (both on-site and remote) will be decided by the aforementioned Faculties and Schools bearing in mind the permitted capacity of classrooms and social distancing measures as established at that time.

The methodology for **full-time students** will be the following:

MASTER CLASSES. The teacher will explain the content specified in the theory syllabus. Students will have access to the graphic material used in the virtual classroom.

SEMINARS. These will include discussion and resolution of theoretical-practical questions arising from the content of the syllabus and from the work done in the laboratory. Students will be informed in advance about these questions in order to be able to study their resolution and actively participate in these sessions. They will also present one of the practices carried out in the laboratory in an oral session.

LABORATORY PRACTICE. Three practices will be done on the analysis of foodstuffs, clinical and environmental. Before each practice session, students will send to the practice teacher the methodology and work plan to be carried out in the lab in order to resolve the analytical problem selected. The teacher will revise and correct the plan designed by the students before going to the laboratory. After the practice work students will hand in a report explaining the results obtained.

COURSE DESCRIPTION

General clarifications on the methodology on case scenario A

A multimodal (hybrid) teaching system will be adopted, combining both on-site and remote classes via videoconference (synchronous) that will be held in the timetable approved by the corresponding Faculty or School. The time distribution of teaching activities (both on-site and remote) will be decided by the aforementioned Faculties and Schools bearing in mind the permitted capacity of classrooms and social distancing measures as established at that time.

The methodology for **full-time students** will be the following:

MASTER CLASSES. The teacher will explain the content specified in the theory syllabus. Students will have access to the graphic material used in the virtual classroom.

SEMINARS. These will include discussion and resolution of theoretical-practical questions arising from the content of the syllabus and from the work done in the laboratory. Students will be informed in advance about these questions in order to be able to study their resolution and actively participate in these sessions. They will also present one of the practices carried out in the laboratory in an oral session.

LABORATORY PRACTICE. Three practices will be done on the analysis of foodstuffs, clinical and environmental. Before each practice session, students will send to the practice teacher the methodology and work plan to be carried out in the lab in order to resolve the analytical problem selected. The teacher will revise and correct the plan designed by the students before going to the laboratory. After the practice work students will hand in a report explaining the results obtained.

EVALUATION

Intended learnig	Exams	Oral Presentation	Placement reports
CB11			X
CB4	X	X	X
CB5		X	X
CB6		X	X
CB9	X	X	X
CE1	X		X
CE16	X	X	X
CE19		X	X
CE23	X	X	X
CE24		X	X
CE28		X	X
CE31		X	X
Total (100%)	50%	20%	30%
Minimum grade	4	4	4

(*)Minimum grade necessary to pass the course

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Attendance will be assessed (Scenario A)?:

No

General clarifications on instruments for evaluation (Scenario A):

A final exam will be given which will account for 50% of the final mark. This exam will consist of 20-25 short-answer questions about the content of the master classes and the seminars. Students must attain a minimum mark of 5.0 (over 10) in the final exam to pass and marks obtained during practice and in the seminars will be considered. Three partial exams will also be given, of an eliminatory character.

The students' work in the practice sessions (30%) and in the seminars (20%) will account for 50% of the final mark.

Repeaters: attendance of students repeating the different activities of the subject will be voluntary. If they choose to do so, they will be evaluated in the same way as freshly-enrolled students. Otherwise, the mark corresponding to practical classes, seminars and group assignments will be that obtained by the student during the course already completed.

Extraordinary call for students of second enrolment or higher. The mark of the seminars and the laboratory practices carried out in previous courses will be maintained and they should only be examined from the theoretical contents (final exam).

Clarifications on the methodology for part-time students and students with disabilities and special educational needs (Scenario A):

Evaluation of part-time students will be made according to the centre's rules and regulations and considering the characteristics of each case.

The methodological strategies and the evaluation system contemplated in this Teaching Guide will be adapted in accordance with the individual case for students with disabilities and special educational needs where required.

Qualifying criteria for obtaining honors (Scenario A):

According to article 80.3 of the Academic Regulations of the University of Cordoba, the

CONTINGENCY PLAN: CASE SCENARIO B

Case scenario B will bring about a suspension of all on-site academic activities as a consequence of health measures.

METHODOLOGY

General clarifications on the methodology on case scenario B

On-site teaching activities will be held via videoconference (synchronous) in the timetable approved by the corresponding Faculty or School. Alternative activities will be proposed for reduced groups in order to guarantee the acquisition of course competences.

The methodology for **full-time students** will be the following:

MASTER CLASSES. The teacher will explain the content specified in the theory syllabus. Students will have access to the graphic material used in the virtual classroom.

SEMINARS. These will include discussion and resolution of theoretical-practical questions arising from the content of the syllabus and from the work done in the laboratory. Students will be informed in advance about these questions in order to be able to study their resolution and actively participate in these sessions. They will also present one of the practices carried out in the laboratory in an oral session.

LABORATORY PRACTICE. Three practices will be done on the analysis of foodstuffs, clinical and environmental.

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Before each practice session, students will send to the practice teacher the methodology and work plan to be carried out in the lab in order to resolve the analytical problem selected. The teacher will revise and correct the plan designed by the students before going to the laboratory. After the practice work students will hand in a report explaining the results obtained.

EVALUATION

Intended learnig	Exams	Oral Presentation	Placement reports
CB11			X
CB4	X	X	X
CB5		X	X
CB6		X	X
CB9	X	X	X
CE1	X		X
CE16	X	X	X
CE19		X	X
CE23	X	X	X
CE24		X	X
CE28		X	X
CE31		X	X
Total (100%)	50%	20%	30%
Minimum grade	4	4	4

(*)Minimum grade necessary to pass the course

Moodle Tools	Exposición oral	Exámenes	Informes/memorias de prácticas
Cuestionario		X	
Tarea			X
Videoconferencia	X		

Attendance will be assessed (Scenario B)?:

No

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General clarifications on instruments for evaluation (Scenario B):

A final exam will be given which will account for 50% of the final mark. This exam will consist of 20-25 short-answer questions about the content of the master classes and the seminars. Students must attain a minimum mark of 5.0 (over 10) in the final exam to pass and marks obtained during practice and in the seminars will be considered. Three partial exams will also be given, of an eliminatory character.

The students' work in the practice sessions (30%) and in the seminars (20%) will account for 50% of the final mark.

Repeaters: attendance of students repeating the different activities of the subject will be voluntary. If they choose to do so, they will be evaluated in the same way as freshly-enrolled students. Otherwise, the mark corresponding to practical classes, seminars and group assignments will be that obtained by the student during the course already completed.

Extraordinary call for students of second enrolment or higher. The mark of the seminars and the laboratory practices carried out in previous courses will be maintained and they should only be examined from the theoretical contents (final exam).

Clarifications on the methodology for part-time students and students with disabilities and special educational needs (Scenario B):

Evaluation of part-time students will be made according to the centre's rules and regulations and considering the characteristics of each case.

The methodological strategies and the evaluation system contemplated in this Teaching Guide will be adapted in accordance with the individual case for students with disabilities and special educational needs where required.

Qualifying criteria for obtaining honors (Scenario B):

According to article 80.3 of the Academic Regulations of the University of Cordoba, the