

**1. General information**

**Course:** METHODOLOGY AND INSTRUMENTATION IN BIOCHEMISTRY  
**Type:** CORE COURSE  
**Degree:** 341 - UNDERGRADUATE DEGREE PROGRAMME IN BIOCHEMISTRY  
**Center:** 501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY  
**Year:** 2

**Main language:** Spanish  
**Use of additional languages:**  
**Web site:**

**Code:** 13309  
**ECTS credits:** 6  
**Academic year:** 2023-24  
**Group(s):** 40  
**Duration:** First semester  
**Second language:**  
**English Friendly:** Y  
**Bilingual:** N

Lecturer: <b>MARIA JIMENEZ MORENO</b> - Group(s): 40				
Building/Office	Department	Phone number	Email	Office hours
Sabatini/0.8	Q. ANALÍTICA Y TGIA. ALIMENTOS	926051710	maria.jimenez@uclm.es	Tuesday, Wednesday and Thursday from 12 p.m. to 14 p.m. Arrange an appointment by email.
Lecturer: <b>ROSA DEL CARMEN RODRIGUEZ MARTIN-DOIMEADIOS</b> - Group(s): 40				
Building/Office	Department	Phone number	Email	Office hours
Sabatini/0.16	Q. ANALÍTICA Y TGIA. ALIMENTOS	5420	rosacarmen.rodriguez@uclm.es	Tuesday, Wednesday and Thursday from 12 p.m. to 14 p.m. Arrange an appointment by email.
Lecturer: <b>ARMANDO SÁNCHEZ CACHERO</b> - Group(s): 40				
Building/Office	Department	Phone number	Email	Office hours
ICAM/Laboratorio 0.22	Q. ANALÍTICA Y TGIA. ALIMENTOS		Armando.Sanchez@uclm.es	

**2. Pre-Requisites**

Not established

**3. Justification in the curriculum, relation to other subjects and to the profession**

It is a compulsory subject that belongs to the area of "Instrumental Methodologies" and, within this, to the module "Biochemical Methods and Molecular Biology of Systems". This course will cover the different stages of the analytical process and provide an overview of the methods of analysis and the most important instrumental analysis techniques, with special emphasis on their biochemical application.

Two types of relationships can be established with the other subjects of the Degree. On the one hand, the group of subjects corresponding to the basic sciences, such as Chemistry, Physics and Mathematics, which will be useful in establishing the fundamentals and applications of the techniques studied. On the other hand, those subjects for which the knowledge acquired in this subject will be an especially useful tool. It is directly related to the subjects "Integrated Laboratory I", "Structural Determination", "Clinical Biochemistry", "Molecular Biology of Systems and Bioinformatics" and "Bioethics, Biosafety and Quality Control", as well as those Subjects of Biomedical Guidance and Clinic, especially with "Clinical Bioanalytics".

Regarding the relationship with the profession, basic tools that have their application in very different fields of professional activity will be studied, although their most direct application is in the professional profile corresponding to the health field and clinical analysis laboratories.

**4. Degree competences achieved in this course****Course competences**

Code	Description
E01	Express themselves correctly in basic biological, physical, chemical, mathematical and computer terms.
E02	Work properly and quality driven in a chemical, biological and biochemical laboratory, including safety, handling and disposal of waste and keeping a record of activities.
E04	To know the principles and applications of the methods and instrumentation used in bioanalytical determinations.
E12	Have the numerical and computational skills to apply mathematical procedures for data analysis.
E13	Correct handling of different computer tools
T01	Proficiency in a second foreign language, preferably English, at level B1 of the Common European Framework of Reference for Languages
T03	A correct oral and written communication
T05	Organizational and planning skills
T08	Ability to work as a team and, where appropriate, exercise leadership functions, encouraging entrepreneurship

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

To be able to estimate the reliability of the analytical results, having a clear idea of the statistical concepts applied for their evaluation, and to understand the validation strategies of the analytical methodologies.

To be able to select the most suitable technique for the analytical study of substances of biochemical interest.  
 Be able to take and treat samples of a biochemical nature for monitoring and analysis.  
 Be able to analyse, interpret and draw conclusions from experimental data.  
 Understand correctly the functioning of the basic instrumentation used in biochemical research  
 Acquire the necessary skills to use relevant techniques in biochemistry.  
 Understand the physico-chemical principles on which the main instrumental analysis techniques are based.

## 6. Units / Contents

### Unit 1: Introduction.

- Unit 1.1 Introduction to biochemical analysis.
- Unit 1.2 Analytical properties. Validation and quality.
- Unit 1.3 Treatment and preparation of samples.

### Unit 2: Spectroscopic techniques.

- Unit 2.1 Introduction to spectroscopic techniques.
- Unit 2.2 UV-visible molecular absorption spectrophotometry.
- Unit 2.3 Molecular fluorescence.
- Unit 2.4 Atomic spectroscopic techniques.

### Unit 3: Electrochemical techniques.

- Unit 3.1 Introduction to electrochemical techniques.
- Unit 3.2 Potentiometry.

### Unit 4: Separation techniques.

- Unit 4.1 Introduction to separation techniques and chromatography.
- Unit 4.2 Gas chromatography.
- Unit 4.3 Liquid chromatography (I): Instrumentation.
- Unit 4.4 Liquid chromatography (II): Modalities.
- Unit 4.5 Electrophoresis.

### Unit 5: Mass spectrometry.

- Unit 5.1 Introduction to mass spectrometry.
- Unit 5.2 Instrumentation and applications.

### Unit 6: Laboratory Sessions.

- Unit 6.1 Spectrophotometric determination of phosphates in biological matrices.
- Unit 6.2 Potentiometric determination in biological fluids.

## 7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E01 E02 E04 E12 E13 T03 T08	0.32	8	Y	Y	Attendance to the laboratory sessions will be compulsory. The student's ability and aptitude as well as their ability to work in a group will be evaluated in these practical sessions. This activity is compulsory and not recoverable. The evaluation of this activity could be recover in the different calls.
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	E01 E12 E13 T03 T05 T08	0.22	5.5	Y	Y	A report about the lab sessions will be delivered in due time and form.
Other on-site activities [ON-SITE]	Assessment tests	E01 E04 E12 E13	0.03	0.75	Y	Y	A written evaluation test about laboratory sessions will be performed.
Study and Exam Preparation [OFF-SITE]			0.03	0.75	N	-	
Class Attendance (theory) [ON-SITE]	Lectures	E01 E04 E12 T01	1.48	37	N	-	Teaching classes will be developed in an interactive way with the students including open discussion. The presentations to follow the classes will be available at the Moodle virtual platform for download.
Study and Exam Preparation [OFF-SITE]			2.4	60	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E01 E04 E12 E13 T01 T05	0.36	9	N	-	These sessions pretend to improve the comprehension of the studied topics through the resolution of numerical exercises and cases studies.
Study and Exam Preparation [OFF-SITE]			0.7	17.5	N	-	
Final test [ON-SITE]	Assessment tests	E01 E12 E13	0.08	2	Y	Y	A final written test about resolution of problems or exercises will be performed. This final test will evaluate problem solving ability.

Final test [ON-SITE]	Assessment tests	E01 E04 T01 T03	0.12	3	Y	Y	A final written test will be performed. This final test will evaluate theoretical contents of the subject.
Other off-site activity [OFF-SITE]	Problem solving and exercises	E01 E04 E12	0.25	6.25	Y	N	During the course, proposed problems will be solved and delivered within the indicated period of time. This activity could not be re-taken.
Other on-site activities [ON-SITE]	Practical or hands-on activities	E01 E04	0.01	0.25	Y	Y	An initial evaluation test will be performed before the lab sessions. This activity will be compulsory and unrecoverable.
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	10.00%	10.00%	A written evaluation test about the laboratory sessions will be performed. This activity will be compulsory and could be re-taken. To average with the rest of the laboratory marks and pass the subject, a minimum grade of 4 out to 10 will be required.
Assessment of problem solving and/or case studies	10.00%	0.00%	During the course, problems and/or cases studies will be solved and delivered within the indicated period of time. This activity is not compulsory and could not be re-taken.
Final test	20.00%	25.00%	This final exam will consist in a written test about the problems solving ability. To average this mark with those obtained in the rest of activities, it will be necessary to obtain in the final test a minimum score of 3.5 points out of 10. To pass the subject, a minimum mark of 4 points out of 10 will be required.
Final test	50.00%	55.00%	This final exam will consist in a written test about the theoretical contents of the subject. To average this mark with those obtained in the rest of activities, it will be necessary to obtain in the final test a minimum score of 3.5 points out of 10. To pass the subject, a minimum mark of 4 points out of 10 will be required.
Practicum and practical activities reports assessment	7.50%	7.50%	The delivery of the lab work report will be compulsory to pass the laboratory sessions. This delivery will be done within the expected period (normally the following week after the completion of the laboratory sessions).
Laboratory sessions	2.50%	2.50%	An initial test will be performed before the lab sessions in order to assess the comprehension about the lab guidelines. This activity will be compulsory and unrecoverable.
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

In order to pass the subject, it will be compulsory to have attended all the laboratory sessions and a minimum grade of 4.0 out of 10 in the evaluation test about the lab sessions.

The evaluation assigned by default to the student will be the continuous evaluation. Any student may request the change to the non-continuous evaluation modality (before the end of the classes period) by sending an email to the professors if they have not completed the 50% of the evaluable activities.

For the calculation of the final grade, the marks obtained in the different activities developed during the course will be considered, but only if a minimum grade of 3.5 out of 10 is obtained in both final tests. The global mark of the subject will be calculated taking into account the percentages of the previous table. To pass the subject it will be compulsory to obtain a minimum grade of 5 points out of 10 in the global mark.

##### Non-continuous evaluation:

In order to pass the subject, it will be compulsory to have attended all the laboratory sessions and a minimum grade of 4.0 out of 10 in the evaluation test about the lab sessions.

For the calculation of the final grade, the marks obtained in the different activities developed during the course will be considered, but only if a minimum grade of 3.5 out of 10 is obtained in the final test. The global mark of the subject will be calculated taking into account the percentages of the previous table. To pass the subject it will be compulsory to obtain a minimum grade of 5 points out of 10 in the global mark.

#### Specifications for the resit/retake exam:

For the retake exam call only the final test and the laboratory sessions evaluation test can be re-taken, applying for the other sections the marks obtained during the development of the course.

The marks obtained in the lab sessions (as long as the mark in the lab test was higher than 4.0) may be kept in the following academic year if the student does not pass the subject.

#### Specifications for the second resit / retake exam:

For the special retake exam call only the final test and the laboratory sessions evaluation test can be re-taken.

**9. Assignments, course calendar and important dates****Not related to the syllabus/contents****Hours** **hours****10. Bibliography and Sources**

<b>Author(s)</b>	<b>Title/Link</b>	<b>Publishing house</b>	<b>Citv</b>	<b>ISBN</b>	<b>Year</b>	<b>Description</b>
Pingarrón Carrazón, José Manuel	Química electroanalítica : fundamentos y aplicaciones	Sintesis		84-7738-663-3	2003	Bibliografía complementaria
Roca, Pilar	Bioquímica técnicas y métodos	Hélice		84-921124-8-4	2003	Bibliografía básica
Rubinson, Kenneth A.	Análisis instrumental	Prentice Hall		84-205-2988-5	2004	Bibliografía básica
Schwedt, Georg	The essential guide to analytical chemistry	John Wiley & Sons		0-471-97412-9	1999	Bibliografía básica
Skoog, Douglas A.	Fundamentos de química analítica	Reverté		84-291-7554-7	2003	Bibliografía complementaria
Skoog, Douglas A.	Principios de análisis instrumental	McGraw Hill		84-481-2775-7	2010	Bibliografía básica
Valcárcel Cases, M.	Técnicas analíticas de separación	Reverté		84-291-7984-4	2003	Bibliografía complementaria
Barceló, Fermín	Técnicas Instrumentales en Bioquímica y Biología	Universitat de les Illes Balears		978-84-7632-808-8	2003	Bibliografía básica
Hernández Hernández, Lucas	Introducción al análisis instrumental	Ariel		84-344-8043-3	2002	Bibliografía básica
Manz, Andreas	Bioanalytical chemistry	Imperial College		1-86094-371-3	2004	Bibliografía básica
Ocon Navaza, M <sup>a</sup> Carmen D'	Fundamentos y técnicas de análisis bioquímico	Paraninfo		84-9732-331-9	2006	Bibliografía básica
Olsen, Eugene D.	Métodos ópticos de análisis	Reverte		84-291-4324-6	2003	Bibliografía complementaria
Bard, Allen J.	Electrochemical methods : fundamentals and applications	John Wiley and Sons		0-471-04372-9	2001	Bibliografía complementaria
Cela, R.	Técnicas de separación en química analítica	Sintesis		84-9756-028-0	2002	Bibliografía complementaria
Dabrio, Manuel V.	Cromatografía y electroforesis en columna	Springer-Verlag Ibérica		84-07-00503-7	1999	Bibliografía complementaria
García Espinosa, Benjamín	Fundamentos y técnicas de análisis bioquímicos : grado super	Algaida		978-84-7647-932-2	2009	Bibliografía básica
García Segura, Juan Manuel	Técnicas instrumentales de análisis en bioquímica	Sintesis		978-84-7738-429-8	2008	Bibliografía básica
Harvey, David	Química analítica moderna	McGraw-Hill Interamericana		84-481-3635-7	2002	Bibliografía complementaria