



1. General information

Course: ADVANCED LABORATORY IN INSTRUMENTAL TECHNIQUES

Type: CORE COURSE

Degree: 2366 - MASTER DEGREE PROGRAMME IN CHEMICAL

Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY

Year: 1

Main language: Spanish

Use of additional
languages:

Web site:

Code: 311124

ECTS credits: 6

Academic year: 2023-24

Group(s): 20

Duration: C2

Second language: English

English Friendly: Y

Bilingual: N

Lecturer: YOLANDA DIAZ DE MERA MORALES - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
Edificio Marie Curie, segunda planta, despacho 2.05	QUÍMICA FÍSICA	926052872	yolanda.diaz@uclm.es	Monday and Wednesday: from 16:00h to 18:00h Tuesday and Thursday: from 12:00h to 13:00h
Lecturer: GEMA DURA GRACIA - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.		Gema.Dura@uclm.es	Monday Tuesday and Wednesday from 16-18 hours
Lecturer: ANTONIO DE LA HOZ AYUSO - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	926295411	antonio.hoz@uclm.es	Monday, Tuesday and Thursday from 16.00 to 18.00 h
Lecturer: FELIX ANGEL JALON SOTES - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno/Planta primera	QUÍMICA INORG., ORG., Y BIOQ.	926052184	felix.jalon@uclm.es	Monday, Tuesday and Wednesday from 5:00 p.m. to 7:00 p.m.
Lecturer: ELENA JIMENEZ MARTINEZ - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
EDIFICIO MARIE CURIE, 2ª PLANTA	QUÍMICA FÍSICA	926052129	elena.jimenez@uclm.es	Mon-Tues-Wends: 13:00-14:00 and 16:00-17:00
Lecturer: MARIA DEL PILAR MARTIN PORRERO - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
Marie Curie, 2ª planta	QUÍMICA FÍSICA	926052614	maripilar.martin@uclm.es	Monday from 11 to 13, Wednesday and Thursday from 16 to 18
Lecturer: JOSE ANTONIO MURILLO PULGARIN - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno	Q. ANALÍTICA Y TGIA. ALIMENTOS	3441	joseantonio.murillo@uclm.es	
Lecturer: ANA MARIA RODRIGUEZ FERNANDEZ-PACHECO - Group(s): 20				
Building/Office	Department	Phone number	Email	Office hours
Politécnico/A23	QUÍMICA INORG., ORG., Y BIOQ.	926051961	anamaria.rfdez@uclm.es	Monday, Tuesday and Wednesday from 4:30 p.m. to 6:30 p.m.

2. Pre-Requisites

Those established for admission to the Master

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

The Advanced Laboratory in Instrumental Techniques subject represents the practical part of the Advanced Structural Characterization Techniques and Advanced Instrumental Analysis Techniques subjects. Chemistry is not understood without a practical component and in this sense this subject brings together the real use of the instrumentation that is studied in the aforementioned subjects.

4. Degree competences achieved in this course

Course competences	
Code	Description
CB09	Students are able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialist and non-specialist audiences in a clear and unambiguous way.
CB10	Students possess the learning skills that will enable them to continue studying in a largely self-directed or autonomous way.
CE04	Evaluate the usefulness of separation, analysis and structural determination techniques for joint application in problem solving, and be skilled in the use of such techniques in both research and routine laboratories applying methods of organic and inorganic analysis and/or synthesis.

CE07	To learn about the possibilities offered by new analytical methodologies in different fields of application, as well as the current trends in analytical chemistry of interest for the development of R+D+I or its implementation in specialised control laboratories.
CE09	To develop experiments that serve as a basis for R+D+I activities in the field of chemistry, facilitating their transfer to the productive world by means of new standardised work procedures validated for routine and/or control laboratories.
CG01	Transfer the concepts and fundamentals of chemistry in the context of scientific research and/or in the specialised profession of the chemist.
CG02	To achieve advanced training in the fundamentals and potential of the instrumental techniques available in chemistry for the development of scientific research and/or application in specialised control laboratories.
CG03	To achieve advanced training in the management and handling of experimental techniques and procedures in the chemical laboratory.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To know how to design and implement standardised procedures with instrumental techniques involving the development of validated methods of analysis and/or chemical characterisation characteristic of advanced methodological development.

Knowing how to strategically process data and interpret results involving advanced tools of metrology, chemometrics and qualimetry.

Knowing how to select, use and adapt, if necessary, the different instrumental techniques for the resolution of specific chemical problems.

6. Units / Contents

Unit 1: Chosen Technique 1 (see comments)

Unit 2: Chosen Technique 2 (see comments)

Unit 3: Chosen Technique 3 (see comments)

Unit 4: Chosen Technique 4 (see comments)

Unit 5: Chosen Technique 5 (see comments)

Unit 6: Chosen Technique 6 (see comments)

Unit 7: Instrumental techniques in a specific research laboratory or in a company

ADDITIONAL COMMENTS, REMARKS

In order to acquire for the student the appropriate profile for their specialization, they must take 6 of the techniques listed below. The choice of techniques that outline your specialization must have the approval of your tutor and may be modified in part for academic reasons by the Master's Academic Committee.

Techniques offered:

- Single Crystal RX Diffraction
- Diffraction RX of powder
- Electron microscopy SEM
- Atomic Force Microscopy (AFM)
- Chemical analysis by XRF
- Thermal analysis: DSC, TGA and heating microscopy
- Particle size: Pycnometry of He, Sedigraph.
- Physical adsorption of gases
- MALDI-TOF mass spectrometry
- FTIR sampling techniques: diffuse reflectance (DRIFTS)
- FTIR spectroscopy with multipass absorption system for the study of processes in gas phases
- Gas chromatography with coupled triple quadrupole spectrometer (GC-MS)
- Gas Chromatography with Time of Flight Mass Spectrometer. Electron Impact (EI) and Field Ionization (FI) (GC-TOFMS)
- Laser induced fluorescence (LIF)
- Proton Transfer Ionization Time of Flight Mass Spectrometry (PTR-ToF-MS)
- Nuclear Magnetic Resonance Spectroscopy in one and two dimensions (including dynamic resonance)
- Study of Vis-UV and fluorescence spectra of molecular compounds in solution
- Estimation of lifetime in excited state of fluorescent and phosphorescent molecules

Topic 7 will be carried out in a specific research group or in a company

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]	Guided or supervised work	CE04 CE07 CE09 CG01 CG02 CG03	3.84	96	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	CB10	0.64	16	N	-	

Analysis of articles and reviews	Reading and Analysis of Reviews	CB10 CE07 CE09 CG01	0.64	16	N	-
(OFF-SITE) Writing of reports or projects [OFF-SITE]	Individual presentation of projects and reports	CG02 CB09 CG01	0.4	10	Y	Y
On-line debates and forums [OFF-SITE]	Online Forums	CB09 CG01	0.2	5	N	-
Study and Exam Preparation [OFF-SITE]	Assessment tests	CB09 CB10 CE04 CE07 CG01 CG02 CG03	0.08	2	N	-
Individual tutoring sessions [ON-SITE]	Guided or supervised work	CB09 CB10 CE04 CE07 CE09 CG01 CG02 CG03	0.2	5	N	-
Total:			6	150		
Total credits of in-class work: 4.04			Total class time hours: 101			
Total credits of out of class work: 1.96			Total hours of out of class work: 49			

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
Practicum and practical activities reports assessment	80.00%	80.00%	80% will consist of a report of the practices carried out.
Other methods of assessment	10.00%	10.00%	On-line activities of the techniques, for example a pre-laboratory questionnaire
Final test	10.00%	10.00%	It will consist of an oral and compulsory presentation of the practical case studied
Total:	100.00%	100.00%	

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:

Attendance at practical sessions is compulsory.

Each evaluation test must reach the minimum score of 4 points to pass the subject, which after weighing all the tests must reach the minimum score of 5.

The oral presentation of one or two practices is mandatory

Non-continuous evaluation:

Attendance at practical sessions is compulsory.

The oral presentation of one or two practices is mandatory

Same criteria as continuous evaluation.

Specifications for the resit/retake exam:

The qualification of those parts in which more than 4 points have been reached can be saved and those in which it has not been reached must be recovered to obtain the minimum average of 5 points.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 7): Chosen Technique 1 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 2 (de 7): Chosen Technique 2 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 3 (de 7): Chosen Technique 3 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17

Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 4 (de 7): Chosen Technique 4 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 5 (de 7): Chosen Technique 5 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 6 (de 7): Chosen Technique 6 (see comments)	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	8
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.33
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	1.33
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	.83
On-line debates and forums [AUTÓNOMA][Online Forums]	.42
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	.17
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	.42
Unit 7 (de 7): Instrumental techniques in a specific research laboratory or in a company	
Activities	Hours
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	48
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	8
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	5
On-line debates and forums [AUTÓNOMA][Online Forums]	2.5
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	1
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	2.5
Global activity	
Activities	hours
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	15.98
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	9.98
On-line debates and forums [AUTÓNOMA][Online Forums]	5.02
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	2.02
Study and Exam Preparation [AUTÓNOMA][Self-study]	15.98
Individual tutoring sessions [PRESENCIAL][Guided or supervised work]	5.02
Class Attendance (practical) [PRESENCIAL][Guided or supervised work]	96
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house Cíty		ISBN	Year	Description
Edmond de Hoffmann y Vicent Stroobant	Mass Spectrometry. Principles and Applications	Wiley and Sons		1118681940, 97811186	2013	
Gross, J	Gross, J Mass Spectrometry: a textbook	Springer International Publishing		3319543970, 97833195	2017	
Stefan Berger, Siegmara Braun	200 and More NMR Experiments: A Practical Course	Wiley	Weinheim	ISBN: 978-3-527-3106	2004	Libro práctico sobre secuencias de pulso y aplicaciones
	https://www.wiley.com/en-us/200+and+More+NMR+Experiments%3A+A+Practical+Course-p-9783527310678					
Helmut H. Telle, Ángel González Ureña	Laser Spectroscopy and Laser Imaging	CRC Press		9781315156989	2017	
	https://doi.org/10.1201/9781315156989					
J.A. Murillo Pulgarín, A. Alañón Molina and F. Martínez Ferreras	Simultaneous determination of nabumetone and its principal metabolite in medicines and human urine by time-resolved fluorescence	Analyst		137(2012)5144-5152	2012	
	https://pubs.rsc.org/en/content/articlelanding/2012/an/c2an35412h#divAbstract					
Martín Martínez-Ripoll;	Cristalografía		Madrid			
	http://www.xtal.iqfr.csic.es/Cristalografia/					
A. K.Cheetham and Peter Day	Solid State Chemistry: techniques	Oxford Science publications	Oxford	0-19-855286-6	2001	ibro de consulta específico

<p>West , A. R.</p>	<p>https://catalogobiblioteca.uclm.es/cgi-bin/abnetopac/O7682/IDbed4c285/NT1 Basic Solid State Chemistry</p>	<p>John Wiley and Sons</p>	<p>New York 0-471-98755-7</p>	<p>1999</p>	<p>Libro de consulta específico</p>
	<p>https://catalogobiblioteca.uclm.es/cgi-bin/abnetopac/O7682/IDbed4c285/NT1</p>				