

# Study Plan

School: Institute for Research and Advanced Training

Degree: Doctorate

Course: Chemistry (cód. 727)

## 1st Year - 1st Semester

Component cours	ivane	Scientific Area Fie			Field ECTS		ntific Area Field   ECTS   Duration		tion Hou	
(	Chemistry Seminar I		Chemistry		6		Semes	ter	156	
QUI13575D										
*** TRANSLATE M	E:Grupo de Optativas de Competências Transversa	is ***	*			1		I		
Component code	Name	Scientific Area Field		EC	TS	Du	ation	Ho	urs	
	Epistemology of Science	Phi	losophy	3 Sem		Semester		78		
FIL13966D										
	Communication techniques	Education Scien-		3		Sen	lester	78		
VIS13967D	·	ces	Design Lin-							
		guis	stics							
	Open Science and strategies of science communica-	Des	sign History In-	3		Sen	lester	78		
HIS13970D	tion and dissemination	forr	matics							
	Academic writing skills in English I	Lin	guistics	3		Sen	lester	78		
LLT13973D			-							
	Academic writing skills in English II	Lin	guistics	3	3 Se		lester	78		
LLT13974D										
	Personal Career Management	Psychology		3		Sen	lester	78		
PSI13968D										
	LaTex Introdution	Informatics		3	3 Semester		lester	78		
INF13969D										
	Project Planning and Management	Ma	nagement	3 Semes		lester	78			
GES13975D										
	Fundamentals of Data Analysis in Environment R	Ma	thematics	6 Sem		lester	156			
MAT14055D										
	Ethics and Research	Phi	losophy	3		Sen	lester	78		
FIL13971D										
	Start-up PhD	Ma	nagement	3		Sen	lester	78		
GES14077D										
	Numerical Tools with Python	Info	ormatics	6		Sen	lester	156		
MAT15034D		Ma	thematics							
	History of Sciences	Phy	sics History	3		Sen	lester	78		
FIS15035D										
	Introduction to automatic bibliographic reference	His	tory	3		Sen	lester	78		
HIS15036D	systems		<u> </u>	-						
DCHEROSED	Emotions in learning contexts	Psy	chology	3		Sen	lester	78		
PSI15037D										



Component code	Name	ield	ECTS [	Duration	Hours	
Options						
Component code	Name	Scientific Area Field	ECT	<sup>-</sup> S Durat	ion   H	ours
011125700	Synthesis and Properties of Nanoporous Materials	Chemistry	6	Semes	ter 15	6
QUI13579D			-			_
	Methodologies of Characterisation of Solids and Sur-	Chemistry	6	Semes	ster 15	5
QUI13580D	faces					
	Advanced Methods in Organic Synthesis	Chemistry	6	Semes	ster 15	6
QUI13581D						
	Mechanisms and Determination of Structure in Or-	Chemistry	6	Semes	ter 15	6
QUI13582D	ganic Chemistry	5				
	Advanced Methods in Computational Chemistry	Chemistry	6	Semes	ster 15	6
QUI13583D						
	Advanced Analytical Techniques and Hyphenated	Chemistry	6	Semes	ter 15	6
QUI13584D	Techniques					
	Microanalysis and In-Situ Analysis Techniques	Chemistry	6	Semes	ter 15	6
QUI13585D						
Free option						
Thesis						

## 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Chemistry Seminar II	Chemistry	6	Semester	156
QUI13576D					



## 1st Year - 2nd Semester

Component code	Name	Name Scientific Area					Name Scientific Area Field		ECTS	Duration H		ırs
*** TRANSLATE M	E:Grupo de Optativas de Competências Transversa	is ***										
Component code	Name	Scientific Area Field	ECTS	5 Dur	ation	Hours						
	Epistemology of Science	Philosophy	3	Sem	ester	78						
FIL13966D												
	Communication techniques	Education Scien-	3	Sem	lester	78						
VIS13967D		ces Design Lin-										
		guistics	2	-								
100100700	Open Science and strategies of science communica-	Design History In-	3	Sem	lester	78						
HIS13970D	tion and dissemination	formatics	2	6		70						
	Academic writing skills in English I	Linguistics	3	Sem	lester	78						
LL113973D	Association ability in Eastick II		2	C		70						
	Academic writing skills in English II	Linguistics	3	Sem	lester	18						
LL115974D	Porsonal Caroor Management		3	Som	octor	78						
PSI13068D	reisonal Career Management	r sychology	5 Semester		lester	10						
1 51155000	La Tex Introdution	Informatics	3 Semester		ester	78						
INF13969D		momutes	o ocinester			10						
	Project Planning and Management	Management	3	Semester		78						
GES13975D												
	Fundamentals of Data Analysis in Environment R	Mathematics	6 Semester		ester	156						
MAT14055D	5											
	Ethics and Research	Philosophy	3 5		ester	78						
FIL13971D												
	Start-up PhD	Management	3	Sem	lester	78						
GES14077D												
	Numerical Tools with Python	Informatics	6	Sem	lester	156						
MAT15034D		Mathematics										
	History of Sciences	Physics History	3	Sem	ester	78						
FIS15035D												
	Introduction to automatic bibliographic reference	History	3	Sem	lester	78						
HIS15036D	systems											
DOLLEDONED	Emotions in learning contexts	Psychology	3	Sem	lester	78						
PSI15037D												

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Synthesis and Properties of Nanoporous Materials	Chemistry	6	Semester	156
QUI13579D					
	Methodologies of Characterisation of Solids and Sur-	Chemistry	6	Semester	156
QUI13580D	faces				
	Advanced Methods in Organic Synthesis	Chemistry	6	Semester	156
QUI13581D					
	Mechanisms and Determination of Structure in Or-	Chemistry	6	Semester	156
QUI13582D	ganic Chemistry				
	Advanced Methods in Computational Chemistry	Chemistry	6	Semester	156
QUI13583D					
	Advanced Analytical Techniques and Hyphenated	Chemistry	6	Semester	156
QUI13584D	Techniques				
	Microanalysis and In-Situ Analysis Techniques	Chemistry	6	Semester	156
QUI13585D					
Free option					
iesis					



### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Chemistry Seminar III	Chemistry	3	Year	78
QUI13577D					
Thesis					

#### 2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Thesis					

#### 3rd Year - 5th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Chemistry Seminar IV	Chemistry	3	Year	78
QUI13578D					
Thesis					

3rd Year - 6th Sen	nester				
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Thesis					

#### 4th Year - 7th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Thesis					

#### 4th Year - 8th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Thesis					

#### Conditions for obtaining the Degree:

\*\*\* TRANSLATE ME: Para conclusão do curso (componente curricular) é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares:

1.º Ano
1 UC obrigatória num total de 6 ECTS no 1º semestre
1 UC obrigatória num total de 6 ECTS no 2º semestre
UC optativas livres - Competências transversais num total de 12 ECTS
UC optativas do grupo de optativas num total de 12 ECTS
2.º Ano

1 UC obrigatória num total de 3 ECTS

3.**≌** Ano

1 UC obrigatória num total de 3 ECTS

Para obtenção do grau, é necessário também a aprovação na Tese com um total de 198 ECTS decorrente no 1.º, 2.º, 3.º e 4.º Ano \*\*\*

# **Program Contents**



#### Chemistry Seminar I (QUI13575D)

The theme to be treated by each student is not fixed and needs prior approval of the jury of the curricular unit. It should be related to the topic of the student's thesis project and should be relevant in view of the objectives and skills that the Doctoral Program in Chemistry aims to develop. The monograph should include some results obtained by the student and with analysis and discussion of the results carried out by the student. It may also include results collected from publications that illustrate applications of the technique. Students are also encouraged to attend conferences.

#### Back

#### Epistemology of Science (FIL13966D)

Contemporary Epistemology and the contributions of the History and Philosophy of Science, Studies of Science and Technology.
 The Scientific Revolution and its repercussions. The unit of knowledge and the organization of the disciplines. The problem of demarcation: science and common sense, religion, art and power.

3.Beliefs, methodologies, scientific truths and justification. The epistemological virtues. Normal science, controversies and innovation.

4. The scientific veracity: the logical-formal, empirical and hermeneutic dimensions. Practices and 'trading zones''. The logic of discovery and of justification. Personae, objectification and ontologies.

5.Special epistemologies: the epistemologies of the social sciences, of life sciences, of engineering and technologies, of arts. Interdisciplinarity, multidisciplinarity and transdisciplinarity.

6. The dynamics of scientific communities an the challenges of the globalization of science: problems of culture, functioning and scientific et



# Communication techniques (VIS13967D)

- 1. Communication:
- general concepts
- channels, codes, meanings and contexts
- noise and communication facilitators
- style
- verbal and nonverbal communication
- oral and written communication

## 2. Written communication:

- different types of writing: formal, informal, academic, literary, journalistic, technical, advertising; social media
- subjectivity vs objectivity
- techniques of plain language writing
- typography, layout and graphics
- non-formal science communication writing
- writing press releases
- writing emails
- writing on social media

## 3. Oral communication:

- different types of oral communication: informative and persuasive
- preparation of an oral presentation
- techniques for facing, captivating and persuading the audience
- the importance of storytelling
- the tone of voice
- nonverbal communication
- visual aids to oral communication information design
- interviews and press conferences
- debates: the art of disagreeing and arguing
- job interviews

# Back

# Open Science and strategies of science communication and dissemination (HIS13970D)

- 1. Fundamental concepts and topics on Open and Citizen Science and their emergent contexts.
- 2. How to publish?
- 2.1. The various types of scientific texts and disciplinary areas.
- 2.2. The peer review.
- 2.3. Indexed publications and impact factors.
- 2.4. The h-index.
- 3. The problems of opening and sharing data: from ethical issues to data intelligibility.
- 3.1. Copyright and creative commons licenses. Permanent links. The patents.
- 3.2. The metadata
- 3.3. The institutional repositories.
- 4. Open and shareable data requirements: from data management plan to preservation issues
- 5. Interoperability.
- 6. Information Representation and Retrieval
- 7. Data Security
- 8. Science communication strategies
- 8.1. The history of science communication and the challenges of modern societies
- 8.2. How to stimulate the intellectual pleasure of critical and scientific thinking?
- 8.3. Strategies to attract and build audiences: emotional design



### $\mathsf{Back}$

## Academic writing skills in English I (LLT13973D)

Unit 1. The writing process: (a) the purpose, types and features of academic writing; (b) types of academic texts; (c) the development of critical reading approaches; (d) planning and brainstorming; key points & note-making; (e) paraphrasing & summarizing; (f) references & quotation; (g) rewriting & proofreading.

Unit 2. Elements of writing: (a) argument and discussion; (b) cause and effect; (c) cohesion; (d) comparison; (e) examples; (f) generalization.

## Back

## Academic writing skills in English II (LLT13974D)

Unidade 1. Accuracy in writing: (a) academic vocabulary; (b) conjunctions, nouns & adjectives, prepositions; (c) punctuation; (d) verbs: passive, referencing, tenses.

Unidade 2. Writing models: (a) reports, case studies and literature reviews; (b) designing and reporting surveys; (c) essays; (d) the PhD thesis.

## Back

## Personal Career Management (PSI13968D)

1. Work and career

- 1.1. The changing nature of work in a globalized society
- 1.2. The importance of personal career management in globalized societies
- 1.3. Models and practices of personal career management
- 2. The development of personal career management skills
- 2.1. My career
- 2.2. Identity
- 2.3. Career adaptability resources
- 2.4. Barriers and supports to personal career management
- 2.5. The implementation of personal career management strategies
- 3. Research on personal career management

#### Back

#### LaTex Introdution (INF13969D)

- 1. Document Organization: Document divisions, Lists.
- 2. Common Documents: Presentations, Tables and Figures.
- 3. Academic Publications: Acronyms, Bibliographies & References.
- 4. Monographs and Books: Multi-File Documents.
- 5. Advanced Topics: Mathematical Expressions, Hyperlinks, Indexes, Graphics.

#### Back

#### Project Planning and Management (GES13975D)

- 1. Project planning, programming and control
- 2. Project programming with deterministic durations
- 3. Project programming with stochastic durations
- 4. Project planning and financial management
- 5. Presentation, resolution and discussion of research project exemples



## Fundamentals of Data Analysis in Environment R (MAT14055D)

- 1. Introduction to the R language
- i. Installation of R, R Studio and libraries
- ii. Use of R as a calculator: mathematical and logical operations
- iii. Data storage: variables, vectors, matrices and lists
- iv. Object classes and object conversion into different classes
- v. Data import, export and storage
- vi. Data manipulation: filters, selections, renames, groupings, sorts, etc.
- vii. Pipe Operator
- 2. Graphical data visualization: categorical, discrete and continuous data
- i. Static graphs
- ii. Dynamic graphs
- iii. Recording graphs in several formats
- 3. Summary measures
- i. Location
- ii. Dispersion
- iii. Form
- iv. Association
- 4. Hypothesis tests
- i. Parametric
- ii. Non-parametric

## Back

## Ethics and Research (FIL13971D)

I. INTRODUCTION - THE PLACE OF ETHICAL QUESTIONING IN SCIENTIFIC AND TECHNOLOGICAL RESEARCH

- I. 1. Research and Science
- I. 2. Science, Technique and Technology
- I. 3. Technological development and Ethics
- II. CONCEPTS, VALUES AND ETHICAL PRINCIPLES IN RESEARCH
- II. 1. Safeguarding human rights by the ethical regulation of research
- II. 2. The common heritage of obligations of information professionals and researchers
- II. 3. The criteria of freedom and responsibility in research
- III. LICITUDE AND LEGALITY IN RESEARCH PROJECTS
- III. 1. Issues of authorship the rights and duties of the researcher
- III. 2. Ethics Committees, codes or letters of conduct and personal decision
- III. 3. Digital Age and research integrity



## Start-up PhD (GES14077D)

- I. Navigating the Entrepreneurs' Sea: why are there start-ups that fail and others that are successful?
- What is an entrepreneur and what is entrepreneurship made of?
- Entrepreneurial personality, entrepreneurial skills and entrepreneurship teams.
- The power of innovation and ingredients to innovate.
- Entrepreneurship and critical sense identify your own weaknesses and threats through SWOT analysis.
- II. Designing a Value Proposition
- The validation of needs.
- How to eliminate the problems of a target audience?
- The conceptualization of a solution / prototype.
- Test and get feedback.
- III. Minimum Viable Product (MVP): from the commitment of features to rapid prototyping
- IV. Lean start-up: an integrated model
- From business strategy to business model: a roadmap for the future.
- The power of business communication.
- V. Intellectual Property and Protection of Innovation
- VI. Funding Sources: from investment rounds to crowdfunding

#### Back

## Numerical Tools with Python (MAT15034D)

- 1. Introduction to SageMath software. Installation.
- 2. SageMath as a calculator: first calculations, elementary functions, Python variables, symbolic variables, first graphs.
- 3. Representation of floating point numbers: properties, rounding.
- 4. Programming and data structure: algorithms (loops, conditions and functions), lists and other data structures.

5. Analysis: symbolic expressions and simplifications, elementary mathematical functions, explicit resolution of equations. Sums, limits, sequences, series, derivatives and integrals. Solving differential equations.

6. Linear algebra: vector and matrix computation, solving linear systems, eigenvalues and eigenvectors computation, matrix decomposition.

7. Graphics: graphical representation of functions, parametric curves, curves in polar coordinates, implicitly defined curves, representation of discrete data, representation of the solution of differential equations.



## History of Sciences (FIS15035D)

Plurality of approaches in the history and philosophy of science and their interest in pedagogy and integral and humanistic training. Aristotelian worldview.

Navigations and the preconditions of the Scientific Revolution.

Scientific Revolution: from Copernicus to Newton.

Kant and the theory of knowledge.

Lavoisier: Chemistry and the respiration of animals.

Laplacian Cosmovision and the development of Thermodynamics.

The consilience of inductions.

The Biological transformism and the anthropological model.

Overcoming mechanism, history and epistemology.

Quanta, relativity: overcoming the classical paradigm.

The history of science place.

Homo faber and the educational value of the history of science.

Institutionalization of HFC: creation of magazines and organization of conferences.

The modular structure of scientific theory.

Contemporary technoscience.

Material culture (laboratories, instruments, collections, etc).

The circulation of knowledge.

Science and values. Science and gender

#### Back

## Introduction to automatic bibliographic reference systems (HIS15036D)

Introduction

- 1. Software installation
- 2. The importance of state of art and the difficulties in doing it
- 3. The main text formats used in the academic world
- 4. Zotero in the context of automatic management systems of bibliographic references
- 5. University libraries, available databases and the Web of Knowledge
- Part I Using Zotero to create my library
- 1. Collecting bibliography with Zotero
- 2. The organization of the library
- 3. Exploration of reading
- 4. Searching within the library
- Part II Reading with Zotero
- Part III Using Zotero for writing academic texts
- 1 Making the notes.
- 2. Styles
- 3.Automatically producing the final bibliography and changinge it

Part IV - Sharing with Zotero

- 1. E-mailing bibliographic references
- 2.Creating groups and sharing a library

#### Back

#### Emotions in learning contexts (PSI15037D)

- 1- Models and explanatory theories on the relationship between emotion and cognition.
- 2- Emotions and feelings in learning experiences
- 3- Emotional regulation in learning contexts



## Synthesis and Properties of Nanoporous Materials (QUI13579D)

#### Theoretical component

Definitions and general principles. Main nanoporous materials and their relevance in scientific and technological contexts. Sol-gel method. Porous structure, fundamentals of methods of preparation and influence of conditions on the porosity of materials, namely: aerogels, activated and super-activated carbon; molecular sieves; zeolites and zeotypes; clays and pillared clays; ordered mesoporous silicas, metalossilicates and carbons; inorganic-organic hybrid materials; porous composite materials. Modification and functionalization to control the properties of materials. Regeneration, importance and methods, of porous materials.

#### Practical component

Preparation of nanoporous materials of various types under different conditions and by different methods. These materials are characterised in the curricular unit of Methodologies of Characterisation of Solids and Surfaces.

#### Back

### Methodologies of Characterisation of Solids and Surfaces (QUI13580D)

Theoretical component

Vacuum theory, systems and equipment. Adsorption methodologies. Helium pycnometry. Mercury

porosimetry. Functional groups, coordinative unsaturation, hydroxylation, Brønsted and Lewis acidity. Isoelectric point and point of zero charge. Non instrumental methods for quantifying surface sites. Interaction of radiation with materials. Techniques for structural and surface characterization of materials. Microscopies (SEM, TEM, AFM, SFM). Techniques involving X rays (XRD, XRF, EDS, XANES, EXAFS, XPS, SAXS). Vibrational spectroscopies (FTIR, Raman) and NMR. Thermal analysis techniques (TGA, DTG, TPD, DTA, DSC and STA).

#### Practical component

Analysis and characterization by different techniques of materials prepared in the curricular unit Synthesis and Properties of Nanoporous Materials.

#### Back

### Advanced Methods in Organic Synthesis (QUI13581D)

Target-oriented synthesis, diversity-oriented synthesis and sustainable synthesis.

Modern catalytic methods, chemocatalytic and biocatalytic methods, organocatalysis and metal-based coupling procedures.

Advanced retrosynthetic analysis.

Heterocycle synthesis.

Modern enabling technologies; alternative solvents, continuous flow processes, microwave assisted synthesis.

Radical based synthesis (photocatalysis).

Synthesis of APIs on an industrial scale; approach to scale-up. Equipment, purity and control at different stages of synthesis at industrial level. Product separation and purification.

#### Back

## Mechanisms and Determination of Structure in Organic Chemistry (QUI13582D)

Provide knowledge on important issues regarding the reactivity of organic compounds, such as advanced pericyclic reactions, mechanisms and their determination, quantitative activity-structure relationships (QSAR) and the stability and reactivity of cyclic compounds.

Provide knowledge on the various spectroscopic and spectrometric techniques for structural analysis of organic compounds.

2D NMR (COSY, HMBC, HMQC, INADEQUATE, NOESY, TOCSY,...). NMR of other important nuclei (15N, 19F, 31P e 29Si).

Mass spectrometry; analysis of the decomposition profiles of various organic compounds.



## Advanced Methods in Computational Chemistry (QUI13583D)

Quantum Chemistry: Hückel, semi-empirical and ab initio methods. Density functional theory.

Quantum dynamics: Time evolution of a quantum system. Time dependent Density functional theory. Electronic transitions. Molecular simulation: Molecular dynamics. Simulations in the micro-canonical, canonical (Nosé-Hoover and Berendsen thermostats) and isobaric (Berendsen and Parrinello-Rahman barostats) ensembles. Geometry constraints. Metropolis Monte Carlo. Canonical, isothermic-isobaric, grand canonical and Gibbs ensembles. Non-Boltzmannean sampling. Thermodynamic perturbation theory. Thermodynamic integration method. Free energies calculations.

Intelligent Systems: Knowledge and Knowledge Representation; Reasoning; Degree of Confidence and Quality of Information. Methods and Techniques. Applications to the area of chemistry. In silico experimentation.

#### Back

#### Advanced Analytical Techniques and Hyphenated Techniques (QUI13584D)

Sample preparation methods and chromatographic analysis

Sample preparation and analyte concentration methods. Review on the chromatographic techniques. New trends in chromatography: high temperature LC, microparticles and monolithic HPLC columns, ultrahigh pressure liquid chromatography, high speed-LC, multidimensional chromatography. Mass detectors, ionization modes and hyphenation with chromatography. Electrochemical Methods

Bulk (Conductometry), static interfacial (Potentiometry) and dynamic interfacial methods (Voltammetry, Chronoamperometry, Chronopotentiometry, Coulometric Titration, Electrochemical Impedance Spectroscopy, Electrochemical Quartz Crystal Microbalance, Electrochemical Mass Spectrometry, Electrochemical Scanning Tunneling Microscopy, Electrochemical Atomic Force and Scanning Electrochemical microscopy, Spectroelectrochemistry, Photoelectrochemistry and Electrochemiluminescence): Miniaturization of electrochemical cells, new sensors, applications.

#### Back

## Microanalysis and In-Situ Analysis Techniques (QUI13585D)

1. Introduction: importance and use of analytical microprobe and in-situ techniques in Chemistry, applications and historical background.

2. Microanalysis techniques

2.1. Sampling techniques and microsample processing

2.2. Microscope based spectroscopic techniques (micro-FTIR and micro-Raman spectrometries)

2.3. Microprobe techniques (Electron microprobe, Proton microprobe, Photon microprobe, Ion microprobe, Laser ablation Inductively coupled plasma Mass spectrometry (LA-ICP-MS)).

3. In-situ techniques

3.1. Spectrometric techniques (in-situ FTIR, in-situ Raman, in-situ XRF and colorimetry)

3.2. Imaging techniques (IR reflectography, radiography, hyperspectral imaging, photogrammetry)

4. Comparison between the analytical techniques: detection limits, analytical precision and accuracy, spatial resolution and applications.



## Chemistry Seminar II (QUI13576D)

The syllabus is not fixed, but is tailored to the particular needs of each student. The theme to be treated needs prior approval of the jury of the curricular unit. It should be related to the topic of the student's thesis project and should be relevant in view of the objectives and skills that the Doctoral Program in Chemistry aims to develop. In the monograph, the student may present a historical overview, but should emphasize the most outstanding recently published work and should also refer to the scientific and societal implications. It may include results obtained by the student and with analysis of the results accomplished by the student. Students must also attend conferences. Examples of conferences organized by the teachers of the curricular unit: "Concentration and thermal applications of solar energy" (M. Collares Pereira, UÉ); "Porous carbon: An efficient and sustainable material for catalysis" (I. Matos, REQUIMTE).

#### Back

## Chemistry Seminar III (QUI13577D)

The formal program consists of attendance at conferences organized under the Doctoral Program and the public presentation and discussion of the research work carried out during the year. Conferences organized by the teaching staff are indicated in the class summaries of the curricular unit. Some examples are: "Fluorescent membrane probes behaviour in lipid bilayers" (L.M. Loura, U.Coimbra); "Design and synthesis of efficient organometallic molecules" (M.H. Garcia, U.Lisbon); "Carbon xerogels: from the lab to the industry" (INCAR, Spain); "Carbon dioxide utilization: opportunities of a global threat" (M.N. Ponte, REQUIMTE). In addition to attendance at conferences organized by the teaching staff, students are encouraged to undertake courses in their specific area of research, and to participate in other conferences/congresses related to the general area of their research taking place either at UÉ or at another institution.

#### Back

#### Chemistry Seminar IV (QUI13578D)

The formal program consists of attendance at conferences organized under the Doctoral Program in Chemistry and the public presentation and discussion of the research work carried out during the year. Conferences organized by the teaching staff are indicated in the class summaries of the curricular unit. Some examples are: "Structure analysis of porous materials by EM" (X.D. Zou,, U.Estocolmo, Suécia); "Synthesis, properties and applications of ionanofluids" (C.N. Castro, U.Lisboa); "Nanostructuring conjugated polymers and polyelectrolytes" (H. Burrows, U. Coimbra); "Sustainability in view of drug delivery" (A. A. Ricardo, REQUIMTE).

In addition to attendance at conferences organized by the teaching staff, students are encouraged to undertake courses in their specific area of research, and to participate in other conferences/congresses related to the general area of their research taking place either at UÉ or at another institution.