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Faculty of Experimental Sciences

TEACHING GUIDES

ACADEMIC YEAR 2022-23

BACHELOR'S DEGREE IN CHEMISTRY

Subject Data

Name:	
AMPLIACIÓN DE QUÍMICA ORGÁNICA DLEX	
English name:	
ADVANCED ORGANIC CHEMISTRY	
Code:	**Type:**
757509219	COMPULSORY

Hours:

	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS:

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4		2		

Departments:	**Knowledge areas:**
QUIMICA.PROF. JOSE CARLOS VILCHEZ MARTIN	ORGANIC CHEMISTRY
Year:	**Semester**
4th COURSE	FIRST SEMESTER

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TEACHING STAFF

Name:	E-mail:	Telephone
* Uwe Pischel	uwe.pischel@diq.uhu.es	959 21 99 82
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Others Data (Tutoring, schedule...)

* Uwe Pischel: Office P4N5-07, CIQSO - Ed. Robert H. Grubbs, 2nd floor.
Tutoring schedule: Tuesday - Thursday 12:00 to 15:00h.

David Guzmán: Office CIPB11.B11, CIQSO - Ed. Robert H. Grubbs, Main floor.
Tutoring schedule: Monday - Wednesday 12:00 to 15:00h.

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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

The subject "Advanced Organic Chemistry" is taught in the first semester corresponding to the fourth year of the Chemistry Degree studies, being the most advanced and compulsory subject that students will face in Organic Chemistry. The main content is divided into two topics, the first one based on mechanistic studies of the *Stereoelectronic* and *Photochemical* effects of certain organic reactions, and the second is the current study in the design and synthesis of complex multifunctional organic compounds. We will carry out the theoretical studies of methods and approaches to achieve the synthesis of different organic compounds, as well as the adequate technical skills about synthetic sequences and methodologies in an Organic Chemistry laboratory.

1.2 In Spanish:

La asignatura de Ampliación en Química Orgánica DLEX se imparte en el primer cuatrimestre del cuarto curso del Grado en Química, siendo la asignatura obligatoria más avanzada que se enfrentará el alumnado dentro del área de la Química Orgánica. El contenido principal de esta asignatura se divide en dos bloques fundamentales, por un lado, los estudios mecanísticos de los efectos estereoelectrónicos y fotoquímicos de determinadas reacciones orgánicas, y por otro lado, el estudio actual del diseño y estrategias en la síntesis de compuestos orgánicos complejos polifuncionales. Se estudiarán los contenidos de ambos bloques, tanto de manera teórica, como práctica, incluyendo secuencias y metodologías sintéticas dentro de un laboratorio de química orgánica.

2. Background:

2.1 Situation within the Degree:

This course allows the students to broaden and strengthen them knowledge in Organic Chemistry, more specifically, the synthetic methodology and organic reactions in total synthesis of organic compounds, even those with interest and applications in the industry and pharmaceutical field. Therefore, this course offers an opportunity to familiarize with basic experimental techniques in organic issues, frequently encountered in research laboratories of companies or public institutions.

2.2 Recommendations

As an advanced course, we recommend having studied and passed previously the courses "Basic Concepts of Organic Chemistry", "Organic Chemistry", and "Organic Chemistry Laboratory".

3. Objectives (as result of teaching):

The main objective is to provide the student with a focus on the current strategies used to achieve the design of organic products. Students will know the methods and strategies for the chemical synthesis of organic compounds, as well as the techniques that are most used in laboratories, in order to optimize the construction of molecular entities using the principle of the retrosynthetic analysis, the minimum number of steps, and the synthesis oriented to the molecular diversity. Likewise, the main pericyclic reactions and photochemical processes as divergent synthetic routes will be studied.

4. Skills to be acquired

4.1 Specific Skills:

C11: Know the properties of aliphatic, aromatic, heterocyclic and organometallic compounds.

C12: Know the nature and behaviour of functional groups in organic molecules.

C13: Know the main synthetic routes in organic chemistry, including the functional group interconversions and the formation of carbon-carbon and carbon-heteroatom bonds.

C2: Know the main types of chemical reaction and the main characteristics associated with each of them.

C4: Know the main techniques of structural research, including spectroscopy.

P1: Ability to safely handle chemical materials, taking into account their physical and chemical properties, including any specific hazards associated with their use.

P2: Ability to carry out standard laboratory procedures involved in analytical and synthetic work, in relation to organic and inorganic systems.

P4: Ability to handle standard chemical instrumentation, such as that used for structural studies and separations.

P6: Ability to carry out risk assessments related to the use of chemical substances and laboratory procedures.

Q3: Aptitude to evaluate, interpret and synthesize information and chemical data.

Q4: Ability to recognize and carry out good practices in scientific and professional work.

Q5: Ability to present, both in written and oral form, scientific material and argumentation to a specialized audience.

4.2 General, Basic or Transversal Skills:

CB1: That students have demonstrated possession and understanding of knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the forefront of their field of study.

CB2: That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defence of arguments and the resolution of problems within their area of study.

CB3: That students have the ability to gather and interpret relevant data (within their area of study in general) to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.

CB4: That students can transmit information, ideas, problems and solutions, to both a specialized and non-specialized audience.

CB5: That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1: That students have developed and demonstrated learning skills and knowledge from their field of study, being able to apply them in their work, interpreting relevant data to make judgments on topics of various kinds, being able to transmit them to both a specialized and non-specialized audience.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Theoretical & Practical Group.
- Laboratory Teaching Group.
- Directed Learning Activity Group.
- Individual work and completing tasks independently.

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5.2 Teaching Methods:

- In-person classes related to the theoretical and practical contents (problems included) of the subject, using teaching resources such as slides, power point presentations, and videos.
- Seminars and conferences on specific topics of the contents of the subject, presentation of video and multimedia material to illustrate topics of the theoretical program.
- Laboratory practices with small groups handling of experimental techniques, discussion of results, obtaining conclusions, presentation of a final report.
- Tutored seminars on problem solving and practical exercises.
- Test and resolution of theoretical-practical questions.
- Discussion of scientific articles.
- Any directed activity that helps to acquire knowledge, skills, and abilities.
- Resolution of questions and doubts.
- Use of Web pages to support the teaching of the subject.

5.3 Development and Justification:

- In-person classes of theory and problems: These sessions will be held with the entire group. Its objective is to structure the concepts and problems of the subject. The teacher's presentation will be supported with the necessary audiovisual resources.
- Seminars and conferences: Knowledge on specific theoretical topics will be expanded with different seminars and/or conferences organized within the subject.
- Laboratory practices: The objective of these sessions is that students can convey the theoretical aspects and/or practical knowledge in the laboratory, acquired in the corresponding in-person classes.
- Tutored seminars and resolution of theoretical-practical questions: Seminars will be held to resolve doubts and questions, both theoretical and practical.
- Discussion of scientific articles: Current scientific articles on the different theoretical aspects of the subject will be discussed.
- Use of web pages: Different web resources and scientific platforms will be shown to support and complement the different theoretical aspects of the subject.

6. Detailed Contents

Topic 1. Introduction to Photochemistry and Pericycle Reactions

Theme 1. Photochemical Process **(4 hours)**.

Theme 2. Cycloaddition Reactions **(4 hours)**.

Theme 3. Electrocyclic and Sigmatropic Reactions **(2 hours)**.

Topic 2. Designing Organic Syntheses

Theme 4. Methods in Organic Chemistry I **(7 hours)**:

Organic reactions as an instrument of synthesis and functional group interconversions (FGI).

Theme 5. Methods in Organic Chemistry II **(3 hours)**:

Selectivity in Organic Chemistry and Protecting groups.

Theme 6. Methods in Organic Chemistry III **(10 hours)**:

Retrosynthetic analysis and Synthesis of Target Organic Molecules.

7. Bibliography

7.1 Basic Bibliography:

- Clayden, J.; Greeves, N.; Warren, S. y Wothers, P.: "Organic Chemistry", 2004, Oxford University Press, ISBN-10: 0-198- 503466; ISBN-13: 978-0198503460.
- Jerry March. "Advanced Organic Chemistry", 2007, Wiley: Hoboken, New Jersey.
- Carey, F. A. y Sundberg, R. J.: "Advanced Organic Chemistry", Part B, 5º Ed. 2007, Plenum Press, New York, ISBN: 0-978- 0-387-68346-1).

7.2 Additional Bibliography:

- N.J. Turro, V. Ramamurthy, J.C. Scaiano. “Modern Molecular Photochemistry of Organic Molecules”, 2010, University Science Books: Sausalito, EE.UU.
- P. Klan, J. Wirz. “Photochemistry of Organic Compounds: From Concepts to Practice”, 2009, John Wiley & Sons.
- Stuart Warren and Paul Wyatt, “Organic Synthesis. The Disconnection Approach” Wiley.
- T. W. Greene, P. G. M. Wuts. "Protective Groups in Organic Synthesis" John Wiley & Sons.
- Nicolau, K. C. y Sorensen, E. J.: “Classics in Total Synthesis”, 1996, VCH: New York.
- Nicolau, K. C. y Sorensen, E. J.: “Classics in Total Synthesis II”, 2003, VCH: New York.
- Nicolau, K. C. y Chen J. S.: “Classics in Total Synthesis III”, 2011, VCH: New York.

8. Systems and Assessment Criteria

8.1 System for Assessment:

- Final Exam.

- Practical Laboratory and Final Report.

- Continuous Assessment.

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Call I

Continuous Assessment will be carried out through:

- Two questionnaires. The first one corresponding to themes 1-3, and the second one, based on themes 4-6. These tests will account for **20%** of the final mark for the subject.

- One written report of laboratory practices and behaviour in the laboratory. This will account for **10%** of the final mark for the subject. It is compulsory to carry out the laboratory practices to pass the subject.

- A final exam that will account for **70%** of the final mark for the subject.

To pass the subject it is necessary to obtain a mark of 5.0 or higher in the final exam and to obtain an average mark of 5.0 in the Continuous Assessment. **In the case that a student obtains a mark lower than 5.0 in the final exam, the average mark of the Continuous Assessment will not be taken into account** and the final mark for the subject will be simply the mark of the final exam.

8.2.2 Examinations Call II

Same as Call I

8.2.3 Examinations Call III
The evaluation in the Call III will be carried out by means of a final exam that will suppose **100%** of the qualification. Where the contents treated in the theoretical, practical, and problem classes will be collected.

8.2.4 Extraordinary Call

The evaluation in the Extraordinary Call will be carried out by means of a final exam that will suppose **100%** of the qualification. Where the contents treated in the theoretical, practical, and problem classes will be collected.

8.3 Single Final Evaluation:

The single final evaluation will be carried out by taking an exam that will account for **100%** of the qualification. This exam will deal with theoretical, practical, and problems. To qualify for the single final evaluation, the student, in the first two weeks of teaching the subject, or in the two weeks following enrolment if this has occurred after the start of the subject, will notify the email to uwe.pischel@diq.uhu.es or david.guzman@ciqso.uhu.es. According to the evaluation regulations approved by the Governing Council on March 13, 2019, this will imply the **express renunciation of Continuous Assessment**, without the possibility that the student can change the evaluation system.

In the final grade for the subject, non-compliance by the student with the basic rules of behaviour and functioning that University Community of the Faculty of Experimental Sciences must respect and that has been approved by the Center Board will be taken into account.