VNIVERSITAT DE VALÈNCIA

Course Guide
36471 Organic Compounds and Materials of Industrial Interest

COURSE DATA

Data Subject	
Code	36471
Name	Organic Compounds and Materials of Industrial Interest
Cycle	Grade
ECTS Credits	4.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	17 - Organic Chemistry Applied	Optional

Coordination

Name	Department
CUÑAT ROMERO, ANA CARMEN	325 - Organic Chemistry

SUMMARY

The subject “Organic compounds and materials of industrial interest” belongs to the section “Applied Organic Chemistry” with 15 ECTS credits. This is an optative subject with 4.5 ECTS credits, which is imparted in the 8th semester (fourth course).

This is a subject with a clear informative character. Is important that the student, as a future candidate for an industrial professional career, recognize the main sectors of the organic chemical industry, such as petrochemical, polymers, colorants, surfactants, agrochemical and pharmaceutical industry.. It involves basic knowledge of the main sources of raw materials, either renewable (petroleum, natural gas or coal) or not renewable (biomass). Additionally, and due to the growing interest of the environmental aspects in the chemical industry, is adequate a basic knowledge of the reactions of organic compounds in the environment, together with the contribution of chemistry to a sustainable development, and the principles that governs the so called green chemistry.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The student should get acquainted with the previously gained concepts of Chemistry and Biology, basic pillars that support an important part of the contents of this subject. Specifically, the study of the general organic chemistry imparted during the second and third year of the grade will help to a better understanding of the contents.

OUTCOMES

1110 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Recognise and evaluate chemical processes in daily life.
- Develop sustainable and environmentally friendly methods.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the matter Applied Organic Chemistry that allow to acquire specific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject Organic compounds and materials of industrial interest related to the competences of the degree in Chemistry.

SPECIFIC KNOWLEDGE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Organic compounds and materials of industrial interes that contemplate the learning outcomes EUROBACHELOR®
Major aspects of chemical terminology, nomenclature, conventions and units.	Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units..(CE1)
The major types of chemical reaction and the main characteristics associated with them.	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)
The kinetics of chemical change, including catalysis; the mechanistic interpretation of chemical reactions	Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry..(CE6).

Major synthetic pathways in organic chemistry, involving functional group interconversions and carbon- carbon and carbon-heteroatom bond formation	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4) Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7). Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8). Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12).
The relation between bulk properties and the properties of individual atoms and molecules, including macromolecules (both natural and man-made), polymers and other related materials.	Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.CE11).
The structure and reactivity of important classes o biomolecules and the chemistry of important biological processes	Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12). Relate chemistry with other disciplines.(CE26).

COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Organic compounds and materials of industrial interest that contemplate the learning outcomes EUROBACHELOR®
Ability to demonstrate knowledge and understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry..(CE13).

Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	Solve qualitative and quantitative problems following previously developed models..(CE14). Recognise and analyse new problems and plan strategies to solve them..(CE15). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate chemistry with other disciplines.(CE26). Prepare reports, surveys and industrial and environmental projects in the field of chemistry..(CE27). Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate. (CG6). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4).

GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Organic compounds and materials of industrial interes that contemplate the learning outcomes EUROBACHELOR®
Competences in information management, in relation to primary and secondary sources, including information retrieval through on-line searches.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6).

	Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Skills related to information technology such as word processing, spreadsheet, recording and storage of data, internet use related to the subjects.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Study skills necessary for professional development. These will include the ability to work autonomously.	Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3). Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Learn autonomously.(CG8). Demonstrate the ability to adapt to new situations..(CG9). Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.(CB5).
Ethical commitment to the European Code of Conduct: http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf	Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.(CG10).

	Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration. (CB3).

DESCRIPTION OF CONTENTS

1. Introduction

The chemical industry, history and economic impact. Chemical production: its major sectors. Evolution of the organic compounds in the environment.

2. No renewable sources of raw materials: oil, natural gas, coal

Oil as a source of basic chemicals. Oil refining. Cracking and reforming. Natural gas as a source of chemicals. Coal as a source of chemicals. Syngas. Basic organic chemicals.

3. Renewable sources of raw materials: biomass

The cycle of organic matter. Biomass. Bio-refineries. Energy and chemicals from biomass. Ingredients for the modern perfumery industry.

4. Organic products in Industry: polimers

Polymers: classification. Types of polymerization. Representative polymers. Composition of commercial plastics. Biodegradable polymers. Polymers and environment.

5. Organic products in Industry: colorants

Color and electromagnetic spectrum. Dyes vs pigments. Pigment types. Main types of dyes: classification. Textile dying. Organic pigments. Food colorant as additives. More food additives.

6. Organic products in Industry: surfactants

Introduction. Properties of surfactants. Classification of surfactants. Commercial detergents: composition, types of additives. Environmental behavior of surfactants. Fatty food systems.

7. Organic products in Industry: plaguicides

Introduction. Classification of pesticides. Mode of action: representative examples. Discovery and development of pesticides. Pesticides and environment.

8. Green chemistry introduction

Green chemistry definition. Green chemistry principles and practical examples.

9. Organic products in Industry: drugs

Main groups of drugs: representative examples. Discovery and drug design. Drugs as emerging contaminants.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Development of group work	7,00	0
Study and independent work	30,50	0
Preparation of evaluation activities	10,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

This subject was conceived to give to the student the role of principal actor of its own learning and is organized in the following manner:

- In-person theoretical classes.

These classes will be dedicated to the exposition to the students of the fundamental aspects of the subject. Thus, the different topics found in the program will be discussed in detail in an orally form. In this manner, the student will obtain a global and comprehensive view of the subject. Both, the blackboard and power point presentations will be used during this time. Previously to the classes, the educational material needed for an easy follow-up of the subject will be introduced in the Aula Virtual.

Those classes will be complemented with the personal work of the student.

- **Practical classes.** In those classes, the application of the concepts introduced in the theoretical classes will be performed for the students. Previously to the attendance of those practical classes, the students will be revised the problems proposed by the professor. The resolution of those problems will be carried out either by the professor or by the students, in an individual form or in a team-work.
- **Tutorial classes.** There will be 7 sessions distributed uniformly along the course. Each session will last for one hour. During those sessions, the professor will evaluate the learning process of the students, which previously and optionally organized in small groups. The difficulties that could arise to the students along the course will be solved, and the students will have guidance in the selection of the most appropriate methods for the resolution of possible future problems.
- **Seminars**. There will be three one-hour seminar sessions. In those seminars, some aspects related to the pharmaceutical industry sector will be discussed in more detail, as an important industrial area with its owns features.

EVALUATION

The student's academic performance and the final grade for the course will be weighted according to the percentages shown in each of the sections evaluated. All grades will be based on the absolute score of 10 points, and according to the scale established in RD 1125/2003. This criterion will be maintained in all calls

The different sections to be evaluated are the following:

1- Direct evaluation of the teacher (0.5 points): In this evaluation different aspects will be taken into account, among which it is worth highlighting:

• Attendance and clear and reasoned participation in the discussions.

• Progress in the use of the characteristic language of organic chemistry.

• Solving problems and raising questions.

• Critical spirit.

2.- Tutorials and seminars (3 points). The note of each student in this section will take into consideration:

• Content and oral and written presentation of the exercises and assignments commissioned by the teacher in each subgroup of work.

3.- Exams (6.5 points): will be held on the date indicated by the Faculty and will be common to all groups in the subject. This test will consist of questions, problems and exercises to assess the student's acquisition of the skills included in the teaching guide. The global pass in the subject will necessarily imply having obtained a minimum score of 3.25 points out of the 6.5 total in the exam

In the evaluation of the second call, the grade obtained in the continuous evaluation (point 1- "Direct evaluation of the teacher" and Point 2 "Seminars") of the first call will be maintained and the part corresponding to the Point will be re-evaluated 3- "Exams".

The student will be eligible to be evaluated only with a written exam on the contents of the subject treated to theory classes, tutorials and seminars, so that the teacher can thus assess whether the student has acquired the skills and knowledge related to the subject. This exam will be 100% of the overall grade. In this case, the student must renounce the continuous evaluation and take advantage of this communicating evaluation modality before the first written summons presented with a registration record to the department secretary.

REFERENCES

Basic

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- PRIMO YUFERA, E.; Química Orgánica básica y aplicada. De la molécula a la industria, Barcelona: Reverté, 2007.
- OLAH, G.A.; MOLNAR, A.; PRAKASH, G.K.S., Hydrocarbon chemistry, New Jersey: John Wiley & Sons, 2018, e-book.
- MESTRES, R., Química Sostenible, Madrid: Síntesis, 2011.
- SIERRA, M. A.; GALLEGO, M., Principios de química medioambiental. Madrid: Síntesis, 2007.

Additional

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- NICHOLSON, J.W., The chemistry of polymers, Cambridge: Royal Society of Chemistry, 2012.
- CHRISTIE, R. M., Colour chemistry, Cambridge: Royal Society of Chemistry, 2015.
- YURKANIS BRUICE, P., Química orgánica 5ED, Pearson, 2008
- DUNN, J. P.; WELLS, A. S.; WILLIAMS, M. T., Green chemistry in the pharmaceutical industry, Weinheim: Wiley-VCH, 2010.
- SCHWARZENBACH, R. P.; GSCHWEND, P. M.; IMBODEN, D. M. Environmental organic chemistry: illustrative examples, problems, and case studies. Wiley & Sons, 2003.

- ANASTAS, P.T.; WILLIAMSON, T. C. Green chemistry: frontiers in benign chemical syntheses and processes, Oxford: Oxford University Press, 1998.
- "ChemBioOffice Ultra, PerkinElmer (CambridgeSoft). Amplia selección de aplicaciones y funcionalidades que permite estudiar, dibujar, formular, modelar y editar estructuras moleculares químicas y biológicas

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

1.- The contents initially indicated in the teaching guide are maintained.

Workload and temporary teaching planning

Regarding the workload:

1.- The different activities described in the Teaching Guide are maintained with the intended dedication.

Regarding the temporary teaching planning:

1.- The material to follow the theory/tutoring/classroom-seminar classes allows to continue the temporary teaching planning both in days and schedule, whether the teaching is face-to-face in the classroom or not.

Teaching Methodology

Theory subjects:

Situation of minimal attendance: In theory classes and tutorials the occupation will be, at most, 30% of their usual occupation. Teaching will be online. Students who have a laboratory session before or after theory classes, and the time to travel is longer than the time established in the schedules, will be able to follow the class in person in the classroom assigned in the schedules. When there are students in this situation, classes will be taught by synchronous videoconference in the group classroom.

Maximum face-to-face situation: In theory classes and tutorials, the occupation will respect the sanitary restrictions that limit the capacity of the classrooms. Depending on the capacity of the classroom and the number of students enrolled, it may be necessary that part of the students have to follow the classes synchronously. If this situation arises, the students will attend the group classroom in weekly rotating shifts (preferably in alphabetical order), so as to ensure that the percentage of attendance of all the students enrolled in the subject is the same.

Confinement situation: If for health reasons it is not possible to continue with hybrid teaching, totally or partially affecting the classes of the subject, these will be replaced by synchronous non-face-to-face sessions following the established schedules and using the virtual classroom tools.

The methodology used for non-face-to-face classes shall be:

1. Synchronously using virtual classroom tools (preferably Blackboard or Teams)

2. Resolution of exercises and questionnaires

If there is a closure of the facilities for health reasons that totally or partially affects the classes of the course, they will be replaced by non-face-to-face sessions following the established schedules and using the tools of the virtual classroom.

In the case of students confined to home due to COVID, they will be ensured on-line teaching through the tools of the virtual classroom.

Evaluation

The evaluation system described in the Teaching Guide of the subject in which the various evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained. Those students who for exceptional reasons renounce the continuous evaluation must communicate it by e-mail to the secretariat of the department (secorgan@uv.es) and to the professor in the term indicated in the teaching guide.

If there is a closure of the facilities for health reasons affecting the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the University of Valencia. The contribution of each evaluable activity to the final grade of the subject will remain unchanged, as set out in this guide.

References

1.- The literature recommended in the Teaching Guide is maintained since it is accessible.