

Academic year
2026/2027

Course Guide:

INDUSTRIAL ORGANIC CHEMISTRY



FACULTY OF
CHEMICAL SCIENCES



1. IDENTIFICATION

Degree Programme	Bachelor's Degree in Chemical Engineering.			Course Code	801558
Course Name	Industrial Organic Chemistry			ECTS	6
Subject Area	Applied chemistry				
Module	Chemical Technology				
Course Type	Optional	Year	Fourth Year	Semester	First Semester
Department	Organic Chemistry				

Teaching Staff

Activity	Lecturer	Email	Office
Lectures/Seminars/Tutorials	AMPARO LUNA COSTALES	alunac@ucm.es	QA329B

2. OBJECTIVES

General objective

- OG1. Introduce the student to the sectors of the Organic Chemical Industry.
- OG2. Introduce the student to the main types of organic compounds generated by the chemical industry and their demand in society.
- OG3. Introduce the student to the fundamental aspects of the synthesis and production of organic products.

Specific objectives

- OE1. To acquire skills enabling the student to transfer knowledge of organic compound reactivity to industrial-scale synthesis.
- OE2. Know the main types of mass-produced organic compounds.
- OE3. Apply the basic concepts acquired about the mechanisms of fundamental organic reactions to the study and understanding of synthetic strategies.
- OE4. Know their synthesis methods.
- OE5. Understand environmental issues, toxicity, and the degradation processes of widely used organic products.
- OE6. Recognize the importance of Organic Chemistry within Science, and its impact on current society (industry, environment, medicine...).
- OE7. Consult and use the proposed bibliography for the development of the course.

3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

Prior knowledge

Proper follow-up of this subject requires that the student has previously acquired the knowledge and skills corresponding to the subject of Organic Chemistry. Although enrolment is not formally conditioned by this prior learning, effective mastery of said knowledge is essential to take this subject with reasonable possibilities of achievement.



Recommendations

It is recommended that the student have a basic level of English that allows them to handle bibliography in English, search for information and communicate in writing and orally in that language. Likewise, it is recommended that you be familiar with computer tools and programs for solving complex problems, as well as applications for writing, editing, and presenting technical reports. Furthermore, for a better use of the subject, knowledge of the nomenclature, structure and reactivity of the main organic functional groups, the fundamental reaction mechanisms in organic chemistry (reactions of substitution, elimination, addition, etc.) and the basic notions of stereochemistry and conformational analysis is recommended.

4. CONTENTS

Brief description

Sectors of the Organic Chemical Industry: methodology for obtaining organic products. Products at laboratory scale, Fine Chemistry and mass production. Polymers: plastics, fibers and elastomers. Surfactants. Dyes and pigments. Agrochemicals and pesticides. Feeding. Drugs. Hygiene and cosmetics. Energy Materials. Industrial fermentations. Toxicity: regulatory and environmental control of organic products.

The subject integrates the principles of green chemistry to design safer, more efficient and sustainable environmental processes.

Course syllabus

Topic 1.

Sectors of the Organic Chemical Industry. Introduction to the main organic products generated by the chemical industry.

Topic 2.

Polymers. Polymerization reactions. Plastics. Fibers. Elastomers. Resins, varnishes and paints. Toxicity and environmental degradation.

Topic 3.

Dyes and pigments. Guys. Staining methods. Dyes from the food industry.

Topic 4.

Surfactants. Guys. Detergents. Toxicity and environmental degradation.

Topic 5.

Cosmetics and hygiene. The cosmetic industry. Perfumes.

Topic 6.

Drugs. The pharmaceutical industry, Development of a drug.

Topic 7.

Agrochemicals and pesticides. Guys. Toxicity and environmental degradation.

Topic 8.

Energy materials.

5. COMPETENCES

General competences

CG1-TQ1

Use concepts for the autonomous learning of new methods and theories.

Specific competences

CE24-QA1	Describe the industrial and economic significance of natural organic products.
CE24-QA2	Explain and understand the structure of the different sectors of the Organic Chemical Industry.
CE24-QA3	Identify and recognise the main products of the Organic Chemical Industry and industrial synthesis methods.
CE24-QA4	Analyse the importance of Organic Chemistry and its impact on industrial and technological society.
CE25-QA1	Recognise the utilitarian properties that determine the use of products, mixtures of products or chemical preparations for consumption, including their safe manufacture and use.
CE25-QA2	Assess the risks, both to the environment and to human health, that may arise from the use of consumer chemical products.
CE25-QA3	Develop methodological guidelines for the use of chemical products and, where appropriate,
CE25-QA4	Apply EU, national and regional regulations concerning consumer chemical products, with

Cross-cutting competences

CT1-TQ1	Develop capacity for analysis and synthesis.
CT2-TQ1	Solving problems in the Chemical Technology field.
CT4-TQ1	Communicate in Spanish using standard audiovisual media.
CT5-TQ1	Consulting, utilising and analysing scientific literature in Chemical Technology.
CT5-TQ2	Consult, use and analyse specialised databases and resources accessible through the Internet.
CT6-TQ1	Use computer tools and programs to calculate, simulate, and approximate.
CT8-TQ1	Demonstrate capacity for critical and self-critical reasoning.
CT11-TQ1	Learn autonomously.
CT12-TQ1	Develop sensitivity to the social and environmental repercussions of engineering solutions.



6. WORKLOAD DISTRIBUTION BY ACTIVITY.

Activity	In-class (hours)	Self-study (hours)	Credits
Lectures	42	63	4,2
Seminars	8	12	0,8
Tutorials/guided work	2	3	0,5
Coursework and Examination preparation	8	12	0,8
Total	60	90	6

7. METHODOLOGY

A mixed methodology will be followed based on cooperative learning, collaborative learning and self-learning. The face-to-face activities of the subject are structured into expository or master theory classes, seminar classes, tutorials and guided activities.

Face-to-face theoretical classes

These classes will be expository, but student participation will be encouraged and rewarded. In them, the headings indicated in the subject programme will be developed orally as face-to-face classes, which will allow the student to obtain a global and comprehensive vision of it. Use of the whiteboard and PowerPoint presentations will be made. At the end of the topic, new proposals may be proposed that allow contents already studied to be interrelated with those of the rest of the subject or with other subjects. Prior to the exhibition, all the material presented necessary to follow the classes will be available to students on the Virtual Campus.

Seminar classes

They will aim to apply the knowledge acquired to a set of questions/exercises. To do this, students will be provided with a collection of exercises related to each topic that makes up the subject. Students will solve the exercises on the blackboard with the teacher's help. Some of the questions will be related to aspects not described in the theoretical development of the subject, so that students can use the knowledge acquired to justify the facts raised therein.

Face-to-face tutorials/Directed activities

Two face-to-face tutorial sessions will be scheduled with small groups of students. For these sessions, material (scientific articles, websites, bibliographic material, conferences, etc.) will be provided through the Virtual Campus to students to delve deeper into a topic related to the subject, which will be discussed in the tutoring session.

8. BIBLIOGRAPHY

At the beginning of the course, the recommended bibliography will be discussed, indicating the most relevant aspects of each text. Given the diversity of the contents of the subject, the list of specific bibliography for each topic is very extensive and is not included here but will be communicated at the beginning of each topic.

- General organic chemistry texts:
 - Carey, F. A.: "Organic Chemistry", 9th Ed, Ed. McGraw Hill, 2014. / Carey, F. A.: "Organic Chemistry", 10th Ed, Ed. McGraw Hill, 2017.
 - Vollhardt, K. P. C. and Schore, N. E.: "Organic Chemistry", 5th Ed., Ediciones Omega, 2008. / Vollhardt, K. P. C. and Schore, N. E.: "Organic Chemistry", 7th Ed., MacMillan Learning, 2015.
- Specific texts from the subject programme:
 - Primo, E.: "Basic and Applied Organic Chemistry: from the Molecule to the Industry", Ed. Reverté, 2012.
 - Sierra, M. A. and Gómez-Gallego, M.: "Principles of Environmental Chemistry", Ed. Síntesis, 2010.
 - Clayden, J.; Greeves, N. and Warren, S.: "Organic Chemistry", 2nd Ed, Ed. Oxford University Press, 2012.

9. EVALUATION

In order to access the final evaluation, it will be necessary for the student to have participated in at least 70% of the face-to-face activities. It is mandatory to attend the two guided tutorials.

All qualifications will be based on the absolute score out of 10 points, and in accordance with the scale established in RD 1125/2003. The final grade will result from the weighted average of the evaluable activities. However, to pass the subject it will be necessary to achieve the minimum grade established in each of them. If this requirement is not met, the final grade will be the weighted average obtained, with a maximum of 4.5 out of 10. These criteria will be maintained in all calls.

The grades of the activities planned for the evaluation of the subject (control exams, tutorials, delivery of problems...) will be communicated to the students sufficiently in advance before the final exam, so that they can adequately plan the study of this or other subjects. In particular, the scores for the control exams will be communicated within a maximum period of 20 days. In any case, the minimum period of ten days will be respected between the publication of the grades and the date of the final exam of the subject.



STANDARD ASSESSMENT

❖ **WRITTEN EXAMS: 70%**

Final exam: 55%

The knowledge acquired will be evaluated by taking a final exam that will consist of questions on the application of concepts learned during the course. The minimum exam grade will be 4.5 points to pass the subject.

Control tests: 15%

A control exam lasting one hour will be carried out, approximately in the middle of the semester. The control will consist of questions about the most important concepts of the topics that have been explained up to that point.

❖ **PERSONAL WORK AND GUIDED ACTIVITIES: 30%**

Tutorials / Seminars: 25%

The evaluation of the individual learning work carried out by the student will be carried out through tutorials/seminars. The student's skill in solving the proposed problems and exercises will be valued.

Attendance and active participation in classes: 5%

Attendance at face-to-face activities and the active participation of the student in all teaching activities will be positively valued in the final grade.

REASSESSMENT

❖ **WRITTEN EXAMINATIONS: 70%**

- ❖ A written exam will be carried out with the same characteristics as in the ordinary call, which will have a value of 70% (corresponding to the assessment of the final exam plus the control tests).

❖ **PERSONAL WORK AND DIRECTED ACTIVITIES: 30%**

- ❖ The grade obtained in the ordinary call will be maintained in the extraordinary call.



ACTIVITY SCHEDULE

UNIT	ACTIVITY	HOURS	GROUPS	START	END
1. Introduction 2. Polymers 3. Dyes and pigments	Lectures	24	1	1st Week	8th Week
	Seminars	4	1		
4. Surfactants 5. Cosmetics and hygiene 6. Drugs	Lectures	12	1	9th Week	13th Week
	Seminars	2	1		
7. Agrochemicals and pesticides 8. Energy materials	Lectures	6	1	13th Week	15th Week
	Seminars	2	1		
	Tutorials*	2	1		

* The weeks of tutorials depend on the overall planning of the course.



SUMMARY OF ACTIVITIES

TEACHING ACTIVITY	ASSOCIATED COMPETENCES	TEACHING ACTIVITY	STUDENT ACTIVITY	EVALUATION	P	NP	TOTAL	C
Theory classes	The corresponding general, transversal and specific competencies	Preparation of the material. Exposition of theoretical concepts.	Prior preparation of classes. Taking notes.	Qualification of the written answers to questions related to the theoretical concepts explained.	42	63	105	35%
Seminars	The corresponding general, transversal and specific competencies	Prior preparation of classes. Application of theory to the resolution of exercises and problems.	Prior preparation of classes. Taking notes. Performing exercises. Formulation of questions and doubts.	Qualification of the answers (approach and result) made in writing for the resolution of practical exercises.	8	12	20	
Tutorials	The corresponding general, transversal and specific competencies	Detailed exercise resolution proposal	Consult the teacher about the conceptual and methodological difficulties encountered when studying the subject.	Qualification of the answers (approach and result) made in writing for the resolution of practical exercises	2	3	5	
Exams	The corresponding general, transversal and specific competencies	Proposal, monitoring and correction of exams/controls. Student qualification.		Assessment of the exam and controls.	6	9	15	70%

P: In-class activities

NP: Non-classroom activities (self-study)

C: Grade