COURSE DATA

Data Subject	
Code	46566
Name	Polymer Science and Technology
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2261 - Master's Degree in Chemical Engineering	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2261 - Master's Degree in Chemical Engineering	12 - Optatividad	Optional

Coordination

Name	Department
BADIA VALIENTE, JOSE DAVID	245 - Chemical Engineering
GIL CASTELL, OSCAR	245 - Chemical Engineering

SUMMARY

The subject Science and Technology of Polymers is an optional subject of the Master's degree in Chemical Engineering, which is taught in Spanish and English during the second semester, and consists of 3 ECTS credits.

This course combines knowledge of the scientific base, properties and characterization of polymeric materials, with technological knowledge of the different transformation methods, as well as aspects related to the degradation and recovery of waste, all within the framework of the circular (bio)economy. This results in advanced training of students in the scientific and technological field of polymer materials.

Specifically, the subject is organized into four different thematic blocks: 1. Introduction to polymer materials; 2. Advanced characterization of polymers; 3. Plastic production technologies; and 4. Circularity in the plastic sector

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

This subject is closely related to Materials Science I and II, as well as Environment and Sustainability, all of them from the study plan corresponding to the Degree in Chemical Engineering. Therefore, prior knowledge of materials science and sustainability is recommended.

Knowledge of English is also recommended in order to be able to successfully pass the practical part of the subject, as well as to be able to access the bibliographical sources available in this language.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

2261 - Master's Degree in Chemical Engineering

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Be able to apply the scientific method and the principles of engineering and economics to formulate and solve complex problems in processes, equipment, facilities and services in which matter changes its composition, state or energy content, these changes being characteristic of the chemical industry and of other related sectors such as pharmacology, biotechnology, materials science, energy, food or the environment.
- Communicate and discuss proposals and conclusions in specialised and non-specialised multilingual forums, in a clear and unambiguous manner.
- Adapt to changes and be able to apply new and advanced technologies and other relevant developments with initiative and entrepreneurship.
- Be able to assess the need to complete their technical, scientific, language, computer, literary, ethical, social and human education, and to organise their own learning with a high degree of autonomy.
- Be able to defend criteria with rigor and arguments and to present them properly and accurately.
- Be able to take responsibility for their own professional development and specialisation in one or more fields of study.
- Apply critical reasoning to their knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience and practice, in order to establish economically viable solutions to technical problems.
- Be able to solve unfamiliar and ill-defined problems that have specifications in competition by considering all possible methods of solution, including the most innovative ones, and selecting the most appropriate, and correct implementation by evaluating the different design solutions.

- Design, build and implement methods, processes and equipment for the comprehensive management of supplies and waste - solids, liquids and gases - in industries and be able to assess their impacts and risks.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The main learning outcomes are:

- Know and be able to predict the behaviour of polymers and polymer-based compounds, according to their nature and production technology.

- Know and know how to apply specific characterization techniques of polymers.

- Know the different degradation mechanisms and the monitoring and stabilization techniques in the polymer industry.

- Know the ways of recovery for plastic waste and be able to determine the most appropriate for a given waste.

- Being able to analyse cases of development of polymeric materials within the framework of the circular (bio)economy.

In addition to those made explicit in the verified memory, the following learning outcomes will be obtained:

- Know how to interpret and use the information necessary to solve the practical cases proposed.

- Become familiar with specialized bibliographic sources to find, select and understand information.

- Know how to critically analyse the results obtained both when solving the problems and the proposed practical applications.

- Make presentations in public with rigor, clarity and order.

DESCRIPTION OF CONTENTS

1. Introduction to polymer materials

1.1. Polymer structure and families.
1.2. Properties of polymer materials.

2. Advanced characterisation of polymers

2.1. Thermal analysis techniques.
2.2. Chromatographic techniques.
2.3. Optical and spectroscopic techniques.

3. Plastics production technologies

3.1. Conventional technologies for the production of thermoplastic materials.
3.2. Conventional technologies for the production of thermosetting materials.
3.3. Additives, nanotechnology, compounding and composite materials.
3.4. Advanced production techniques.

4. Circularity in the plastics sector

4.1. Stability and degradation.
4.2. Mechanical recovery.
4.3. Chemical recovery.
4.4. Bioplastics: renewable and/or biodegradable.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Classroom practices	10,00	100
Attendance at events and external activities	2,00	0
Development of group work	10,00	0
Development of individual work	4,00	0
Study and independent work	4,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	5,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

The teaching methodology will consider the following aspects:

- Theory sessions. The students will be offered a global vision of the subject to be discussed and the key concepts that must be developed will be emphasized, as well as the resources to be used for the preparation of the subject in depth. In these sessions, some practical applications may be raised, as an example, in order to enhance the assimilation of the concepts introduced. The theory sessions will be taught in Spanish.
- Practical sessions. On the one hand, the teaching staff will carry out a series of typical problems, exercises and case studies through which the acquisition of competences on the different aspects of the subject will be encouraged. On the other hand, the students will work similar activities, with the supervision of the teaching staff. Likewise, other practices for autonomous and/or group work will be proposed. The practical sessions will be taught in English.

EVALUATION

The evaluation of the subject consists of:

- ACT: Activities. List of specific tasks deliverable throughout the development of the subject. There is no minimum individual grade or global weighting established.

- TR: Work. Group project that will be developed throughout the course, and that will be presented at the end of the course. Minimum note to ponder: 5.0.

The evaluation of the subject will be, both in ordinary call and in extraordinary call, the best of the two modalities that are shown below:

Mod A: 80% TR + 20% ACT

Mod B: 50% TR + 50% ACT

In any case, the evaluation system will be governed by the provisions of the Regulations for Evaluation and Qualification of the University of Valencia for Bachelor's and Master's Degrees (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

REFERENCES

Basic

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J. A. Brydson. Plastics Materials. Elsevier, 1999.
- A. K. van der Vegt. From Polymers to Plastics. VSSD, 2006.
- G. W. Ehrenstein. Polymeric Materials: Structure, Properties and Applications. Hanser Publishers, 2001.

- R. J. Young, P. A. Lovell. Introduction to Polymers, Third Edition. CRC Press, 2011.
- Z. Li, J. Lim, C.-G. Wang. Circularity of Plastics: Sustainability, Emerging Materials, and Valorization of Waste Plastic, 1st Edition. Elsevier, 2023
- V. Voet, R. Folkersma, J. Jager. Plastics in the Circular Economy. De Gruyter, 2021