Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2025/26

Faculty 215 - Faculty of Chemistry

Cycle .

Degree GQUIMI20 - Bachelor's Degree in Chemistry

Year Fourth year

COURSE

26116 - Chemical & Physical Characterisation of Macro-molecules

Credits, ECTS: 6

COURSE DESCRIPTION

The subject macromolecular chemical and physical characterization belongs to the fourth year of the Chemistry degree and is included in the advanced modulus of this degree. The subject is part of the Macromolecular Materials Curricular line is optative and presents theoretical/practical character. Both, the lectures and the laboratory practices are held in the first quarter.

The subject gives to the student the ability for macromolecular materials chemical (Infrared spectroscopy, Nuclear Magnetic Resonance) and physical (molecular weight and its distribution, thermal transitions and morphology)characterization.

To understand this subject it is very convenient to have passed in the third course the subject organic compounds espectrophotometrical identification and to be enrolled in the subject Materials science. This subject is complemented with the other subjects of the macromolecular materials curricular line, especially with the subjects Macromolecular chemistry and Macromolecular materials I.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The subject is included in the Macromolecules line, and forms part of the advanced modulus and thus, it shares its cross-skills. Specifically the skills [M03CM03] [M03CM11] [M03CM12] [M03CM13] [M03CM17] and [M03CM018].

M03CM03: Possess the ability to understand and use the experimental methods of analysis and characterisation of the most representative properties of macromolecular substances and interpret the results returned in terms of the relationship between structure and properties.
M03CM11: Be able to design, programme and carry out experimental processes and use adequate instrumental techniques for different types of chemical problems.
M03CM12: Possess knowledge of the network tools and services that enable searches for information in the field of chemistry and similar fields.
M03CM13: Transmit phenomena and processes related to chemistry and similar fields in verbal presentations and/or written reports and in a comprehensible way in either of the two official languages of the Autonomous Community of the Basque Country or in English.
M03CM17: Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism.
M03CM18: Demonstrate a capacity for learning and for autonomous work for professional development.

The coordination of this subject with the others of the line corresponds to the Chemistry Degree Commission that will be elected by the Faculty board.

Theoretical and Practical Contents

Theoretical part

Identification and analysis methods. General concepts for the macromolecular analysis.
Use of the spectroscopic techniques in the polymer analysis. Infrared spectroscopy (FTIR) and 1H and 13 C Nuclear Magnetic Resonance (NMR)
Molecular weight and dispersity. Macromolecules in solution. Experimental methods to determine the molecular weight.
Thermal properties and its characterization. Amorphous and crystalline polymers. Glass transition. Melting and crystallization. Thermal analysis methods.
Characterization of micro and nanostructures. Electron microscopy.

Practical part
Analysis of commercial samples by FTIR spectroscopy
Molecular weight calculation
Measurements of the thermal properties

TEACHING METHODS

The course is constituted by the following activities
- Lectures, focus on providing basic knowledge of the subject.
- Practical Classroom Work hours, are directed to the application of the acquired theoretical knowledge to solve problems posed by the professor.

- Individual assignments will be part of the self-study hours of the students, and consist of the resolution of problem sets.
- Practical Lab Work is held in group. In the Lab, commercial polymeric samples will be analyzed applying the concepts obtained in the previous activities.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40		5	15					
Horas de Actividad No Presencial del Alumno/a	60		10	20					

Legend:
M: Lecture-based
S: Seminar
GA: Applied classroom-based groups
GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 55%
- Exercises, cases or problem sets 25%
- Individual assignments 10%
- Class attendance and participation 10%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The written exam will account for 55 % of the final mark, and will contain theoretical and practical questions. By means of this part skills M03CM03, M03CM11 and M03CM17 will be evaluated. A continuous evaluation based on the participation in the classroom activities (10%) and the resolution of the individual assignments will be used (10%). By means of this part skills M03CM03, M03CM12, M03CM13 and M03CM17 will be evaluated.
Practical Lab Work is mandatory in the continuous evaluation and will be evaluated based on the progress of the student in the lab and the submitted final report. This evaluation will account for 25% of the final mark. By means of this part skills M03CM03, M03CM11, M03CM12, M03CM13, M03CM17 and M03CM18 will be evaluated.
The student must obtain a minimum mark of 5.0 in each part (written exam, individual assignments, clas attendance and practical Lab Work).

Criteria for continuous assessment waiver are those established in Chapter 2, Articles 8 and 12 of the Student Assessment Regulation for Bachelors Degrees of the UPV/EHU.
Criteria for final evaluation request are those established in Chapter 2, Article 8 of the Student Assessment Regulation for Bachelors Degrees of the UPV/EHU. In that case, the final evaluation will contain theoretical and practical questions and a laboratory practice. By means of this exam skills M03CM03, M03CM11, M03CM12, M03CM13, M03CM17 and M03CM18 will be evaluated.
-No presentado- grade is given if the student gets does not take part in the final exam, as established in Chapter 2, Article 12 of the Student Assessment Regulation for Bachelor’s Degrees of the UPV/EHU.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the 2nd convocation (July) the student will be evaluated exclusively by means of the mark obtained in a written exam.

MANDATORY MATERIALS

Lab coat and glasses are needed in the laboratory.

BIBLIOGRAPHY

Basic bibliography

1. Polímeros. J. Areizaga, M. Cortázar, J.M. Elorza, J. J. Iruin. Editorial Síntesis, 2002.
2. Plastics Analysis Guide: Chemical and Instrumental Methods.
A. Krause, A. Lange. M. Ezrin. Hanser Publishers, 1983.
3. Introduction to Polymer Analysis
T. R. Crompton. Smithers, 2009.
4. Thermal Characterization of Polymeric Materials (Vols 1,2). E. A. Turi. Academic Press, 1997.

Detailed bibliography

M. Chanda, Introduction to Polymer Science and Chemistry: A problem solving approach. CRC Press, 2006.
Seymour/Carraher's Polymer Chemistry. C.E. Carraher, Jr. CRC Press, 2008.
F.A. Bovey and J. Jelinski, Chain Structure and Conformation of Macromolecules. Academic Press, 1982.

F.A. Bovey and P.A. Mirau, NMR of Polymers. Academic Press, 1996.
C. Randall, Polymer Sequence Determination. 13C-NMR Method. Academic Press, 1977.

Journals

Macromolecules
Polymer
Polymer Degradation and Stabilization
Vibrational Spectroscopy

Web sites of interest

Macrogalleria: http://pslc.ws/spanish/index.htm
http://macro.lsu.edu/corecourses/msweb4/VirtualBook/Ch7_Morphology/Ch7_MorophologyMicroscopyScattering_mm.ppt

OBSERVATIONS

The student must obtain a minimum mark of 5.0 in each part (written exam, individual assignments, class attendance, practical Lab Work).