Polymeric Materials and Biomaterials

Code: 102510
ECTS Credits: 6

2025/2026

Degree	Type	Year
Chemistry	OT	4

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is advisable to have passed the subjects "Fundamentals in Chemistry I" and "Structure and Reactivity of Organic Compounds".

The subject is taught entirely in English, thus it is almost essential to have a good knowledge of this language.

Objectives and Contextualisation

In "Polymeric materials and biomaterials" we will study the chemcial and physical properties of most important polymers and the main preparation method and applications. Basic concepts about characterization methods will be given.

The objectives of the course are:

1 Identify the main synthetic polymers.

2 Be familiar with the most important methods for the preparation and characterization of polymeric materials and biomaterials.

3 Determine and represent the structure of organic polymers and biomaterials.

4 Find out the properties of polymeric materials depending on their structure.

5 Describe the main applications of polymeric materials and biomaterials based on their structure.

Competences

- Apply knowledge of chemistry to problem solving of a quantitative or qualitative nature in familiar and professional fields.
- Be ethically committed.
- Communicate clearly in English.
- Communicate orally and in writing in one's own language.
- Develop synthesis and analyses studies in chemistry from previously established procedures.
- Evaluate the health risks and environmental and socioeconomic impact associated to chemical substances and the chemistry industry.
- Handle chemical products safely.
- Handle standard instruments and material in analytic and synthetic chemical laboratories.
- "Interpret data obtained by means of experimental measures, including the use of IT tools; identify their meaning and relate the data with appropriate chemistry, physics or biology theories."
- Learn autonomously.
- Manage, analyse and synthesise information.
- Manage the organisation and planning of tasks.
- Obtain information, including by digital means.
- Propose creative ideas and solutions.
- Reason in a critical manner
- Resolve problems and make decisions.
- Show an understanding of the basic concepts, principles, theories and facts of the different areas of chemistry.
- Show initiative and an enterprising spirit.
- Show motivation for quality.
- Show sensitivity for environmental issues.
- Use IT to treat and present information.
- Use the English language properly in the field of chemistry.
- Work in a team and show concern for interpersonal relations at work.

Learning Outcomes

1. Analyse the composition, structure and molecular weight of polymeric materials using the most common measurement and characterisation techniques.
2. Be ethically committed.
3. Communicate clearly in English.
4. Communicate orally and in writing in one's own language.
5. Describe the kinetics, mechanisms, polymerisation techniques and most relevant examples of polymerisation reactions by stages and in chain.
6. Distinguish the main types of soft matter and their properties.
7. Identify the environmental impact of the use of polymeric materials and recycling demands.
8. Identify the main parameters used to describe the thermomechanical behaviour of polymers, as well as other physical and chemical properties of interest.
9. Justify the results obtained in the laboratory from processes of synthesising and characterising solid, soft and nano materials on the basis of knowledge of their structure and properties.
10. Learn autonomously.
11. Manage, analyse and synthesise information.
12. Manage the organisation and planning of tasks.
13. Obtain information, including by digital means.
14. Predict the product formed in polymerisation reactions.
15. Prepare and characterise nanomaterials.
16. Prepare and characterise polymeric materials and other types of soft matter.
17. Properly handle the chemical products required to prepare solid, soft and nano materials.

18. Properly use the required material and instruments to prepare and characterise solid, soft and nano materials.
19. Propose creative ideas and solutions.
20. Propose the best processing methods and additives for polymeric materials in accordance with their end applications.
21. Read, analyse and extract information from texts in the English language on the different areas of the field of material chemistry.
22. Reason in a critical manner
23. Recognise the English names of terms in the field of material science.
24. Recognise the English names used in the field of preparing and characterising solid and soft materials, as well as in nanochemistry and nanomaterials.
25. Resolve problems and make decisions.
26. Show initiative and an enterprising spirit.
27. Show motivation for quality.
28. Show sensitivity for environmental issues.
29. Synthesise and characterise solid materials with electrical, magnetic or optical properties, and measure said properties.
30. Use IT to treat and present information.
31. Work in a team and show concern for interpersonal relations at work.

Content

1. Introduction: classification, nomenclature, composition, structure and morphology of synthetic polymers.

2. Synthesis and applications of polymers: classification of polymerization reactions (step-growth and chain polymerization, copolymerization, polymer curing, etc.).

3. Rheology and properties of polymers. Characterization techniques of polymers.

4. Formulation and processing: composites, fillers and additives. Polymer technology. Environmental aspects.

5. Soft matter: definition, liquid crystals, surfactants and colloids.

6. Biomaterials and natural polymers: introduction, main tissues, biomedical materials, natural polymers from plants and animals.

Laboratory practices
Synthesis and characterization of polymers of different nature.
Qualitative analysis and determination of polymer properties.

WARNING ON SECURITY IN THE LABORATORY
Any student involved in an incident because of negligence of security measures may be expelled from the laboratory and fail the course.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	34	1.36	1, 3, 4, 26, 27, 5, 6, 8, 21, 2, 28, 14, 20, 19, 23, 24
Practical exercises	18	0.72	1, 3, 27, 5, 16, 11, 12, 8, 7, 9, 17, 18, 28, 22, 23, 24,

			29, 31
Type: Supervised			
Tutoring	4	0.16	10, 3, 26, 27, 21, 28, 19, 22, 23, 24
Type: Autonomous			
Reading of texts and recipes, and writing reports	23	0.92	3, 11, 12, 9, 21, 13, 22, 23, 24, 31, 30
Studying and exercises solving	64	2.56	1, 10, 4, 26, 27, 5, 6, 11, 8, 21, 28, 13, 14, 20, 19, 23, 24, 25, 30

Students will be involved in different types of activities throughout this course:

a) Directed activities: In the classroom, lectures or flipped classroom about the contents of the subject will be carried out. In addition, questions and exercises will be solved. Students will also carry out laboratory sessions, consisting of the synthesis and characterization of polymeric materials.

b) Supervised activities: There will be tutorials to monitor the progress of students with different aspects of the subject when required.

c) Autonomous activities: Students will study the contents of the course and solve exercises on their own. They will also read related texts and perform laboratory experiments following protocols. They will write reports on their experimental results.

Teaching material

Students will have access to the slides used during lectures. These materials should be complemented by students using the suggested bibliographic resources.

Face-to-face classes

The face-to-face classes will be dedicated to the following aspects:

- To present and discuss the most difficult concepts of the subject, and to solve the doubts that may appear in lectures.

- To solve/comment exercises, that must have been previously solved by the students.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Laboratory module	20%	1	0.04	1, 3, 26, 27, 5, 16, 15, 11, 8, 7, 9, 17, 18, 28, 19, 23, 24, 29, 31
Writing exams module	80%	6	0.24	10, 3, 4, 26, 27, 5, 6, 11, 12, 8, 7, 21, 2, 28, 13, 14, 20, 19, 22, 23, 24, 25, 30

The assessment will be based on two modules, each having a specific weight in the final grade:

Practical module: this module is compulsory to pass the subject for all the students. The lab will be evaluated based on the ability and commitment demonstrated during laboratory sessions (40%) and the contents and quality of a brief report (60%) to be submitted electronically in English on the date indicated by the lab supervisors. The mark obtained in this practical module is equivalent to 20% of the final grade for the course.

In the case of a second enrollment to the course, students who have achieved the skills of the practical module in previous years (with a rating equal to or greater than 5.0 out of 10) they do not need to perform the practical module again.

Written test module: it will consist of two partial tests with a weight of 40% each. The subject is considered passed when the average of the two tests grades is equal to or greater than 5.0 points out of 10, provided they have obtained a minimum of 4.0 out of 10 in both tests. If the final mark of the written test module is lower than 5.0 out of 10.0, it will be necessary to retake one or both failed exams with a score lower than 5.0 out of 10.

Passing the subject: To pass the subject it is necessary to have an average of 5.0 out of 10.0 of the two modules and to have completed the practical module.

Recovery exam: To undertake the recovery exam, the student should have previously been evaluated of all the continuous evaluation activities (two written exams and the laboratory sessions).

Students who do not pass the minimum scoring in the first and/or second written test and those with an average of less than 5.0 out of 10.0 for the overall subject can make a recovery exam, of the failed test or tests, after the second written test. The completion of this test involves giving up the qualification obtained in the firts and/or second written tests, but will keep the scoring and the weight of the practical module (20%), which can't be retaken.

When the number of assessment activities carried out is less than 25% (the practical module and two written tests), the grade will be "Not assessable".

Single assessment: The single assessment is only applicable to the written tests module, and will consist of a single test in which the contents of the whole subject program will be evaluated using different types of exercises (multichoice questions, problem solving, concept development, etc.). The grade obtained in this test will account for 80% of the final grade of the subject. The minimum grade to pass the subject is a 5.0 out of 10 for this single test. The written tests module test for the single assessment modality will take place on the same day, time and place as the last continuous assessment test for the subject. The single evaluation of the written tests module can be recovered on the day set for the recovery of the subject, provided that the student has completed both the laboratory sessions and the written test. A student is graded as "*non-assessable*" following the same criterion as for the continuous evaluation. The review of the final grade follows the same procedure as for the continuous assessment.

Bibliography

Polymer Chemistry, C. E. Carraher, Jr. 10th edition, CRC 2017 (or any other previous edition). Available online: https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991000616389706709

Polymer Chemistry, S. Koltzenburg, M. Maskos, and O. Nuyken, 1st edition, Springer, 2017. Available online: https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010401285506709

Introduction to Soft Matter: Synthetic and Biological Self-Assembling Materials, I. W. Hamley, Wiley,2007. Available online: https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991010342937206700

Polymer Synthesis: Theory and Practice, D. Braun, H. Cherdron, M. Rehahn, H. Ritter, B. Voit, 5th edition, Springer 2013.

Software

Ther is no recommended computer program for this subject.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	English	first semester	afternoon
(PLAB) Practical laboratories	2	English	first semester	afternoon
(TE) Theory	1	English	first semester	morning-mixed