Course guide
295568 - 295EQ232 - Biopolymers and Bioplastics

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Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
702 - CEM - Department of Materials Science and Engineering.

Degree: MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2019). (Optional subject).
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: LUIS JAVIER DEL VALLE MENDOZA

Others: Segon quadrimestre:
TOBIAS MARTIN ABT - Grup: T1
LUIS JAVIER DEL VALLE MENDOZA - Grup: T1
NEKANE LOZANO HERNÁNDEZ - Grup: T1
ORLANDO ONOFRE SANTANA PEREZ - Grup: T1

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
CGMUEQ-06. Have the capacity to analyze and synthesize the continuous progress of products, processes, systems and services using safety, economic viability, quality and environmental management criteria
CGMUEQ-10. Adapt to changes, being able to apply new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit

Transversal:
02 SCS. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

Exhibition classes and presentation of works

LEARNING OBJECTIVES OF THE SUBJECT

Specific:
CEMQ1. Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, with critical reasoning to establish economically viable solutions to technical problems.
CEMQ9. Manage Research, Development and Technological Innovation, taking into account the transfer of technology and property and patent rights.
CEMQ13. Realization, presentation and defense, once all the credits of the syllabus have been obtained, from an original exercise carried out individually before a university court, consisting of a comprehensive project of Chemical Engineering of a professional nature in which the competences acquired in the teachings are synthesized. .
Generic:
CGMQ4. Carry out the appropriate research, undertake the design and lead the development of engineering solutions, in new or unfamiliar environments, relating creativity, originality, innovation and technology transfer.
CGMQ6. Be able to analyze and synthesize the continuous progress of products, processes, systems and services using criteria of safety, economic viability, quality and environmental management.
CGMQ11. Possess the skills of autonomous learning to maintain and improve the skills of chemical engineering that allow the continuous development of the profession
Transversal:
CT3. TEAMWORK: Being able to work as a member of an interdisciplinary team, either as a member or performing management tasks, in order to contribute to develop projects with pragmatism and sense of responsibility, assuming commitments taking into account the resources available

STUDY LOAD

Type	Hours	Percentage
Self study	108,0	72.00
Hours large group	42,0	28.00

Total learning time: 150 h

CONTENTS

1. Biopolymers and bioplastics

Description:
Introduction to biopolymers and bioplastics. Carbohydrates, lipids, proteins and nucleic acids. Polymeric biomaterials.

Full-or-part-time: 2h
Theory classes: 2h

2. Biomaterials and biocompatibility

Description:
Biomaterials: classification. Biocompatibility and hemocompatibility. Response of living beings. Regulations and biocompatibility tests. Modification of surfaces. Analysis of surfaces. Sterilization Biomaterials: classification.

Full-or-part-time: 2h
Theory classes: 2h

3. Biostenibilidad and biodegradability

Description:
Sustainable development. Green chemistry: the atomic economy. The parameters of sustainability. Analysis of biological cycles. Toxicity. Biodegradability Mechanisms of biodegradation and evaluation methods. Regulation of sustainability. Bioplastics.

Full-or-part-time: 5h
Theory classes: 5h

4. Sustainable monomers

Description:
Traditional monomers of natural origin. Chemical and biotechnological processes of production. Green catálisis. Sustainable ethylene: bioethanol. Sustainable additives: green plasticizers. Lignin as a source of monomers.

Full-or-part-time: 3h
Theory classes: 3h

5. Sustainable polymers and bioplastics

Description:
Impact of the manufacture and use of polymers. New synthesis strategies Sustainable piolimerization methods. Substitution of traditional toxic monomers: new alternatives. New bioplastics from carbohydrates and natural oils. Polylactic acid Contribution of recycling techniques.

Full-or-part-time: 5h
Theory classes: 5h

6. Nanostructured polymers and copolymers

Description:
Biopolymers of technological interest: starch and cellulose. Protein biopolymers. Modifications and industrial applications. Bacterial polymers: polyesters and polysaccharides. Industrial applications Economic aspects.

Full-or-part-time: 3h
Theory classes: 3h

7. Polymeric biomaterials

Description:
Surgical sutures. Adhesives Polymeric cements Dental restorations and implants. Hydrogels Contact lenses. Artificial skin Polymers in pharmaceutical tablets. Controlled release of drugs.

Full-or-part-time: 6h
Theory classes: 6h

8. Advanced bioplastics

Description:
New biocomposites based on bioplastics. Flexible and low migration bioplastics. Hybrid bioplastics. Sustainable coatings based on bioplastics: paints and plastic coatings.

Full-or-part-time: 5h
Theory classes: 5h

9. Bioplastics based on peptides and polypeptides

Description:
Bioplastics based on polypeptides. Bioplastics obtained from self-assembly of peptides: Peptide materials. Conjugated bioplastics.

Full-or-part-time: 5h
Theory classes: 5h

10. Processing of biopolymers and bioplastics

Description:
Processing of biopolymers and bioplastics. Additives Plasticizers. Extrusion. Injection. Micro and nanoprocessed.

Full-or-part-time: 6h
Theory classes: 6h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

NC = (NP1 + NP2 + NP3) / 3
Where NC is the course grade and NP1-NP3 are the marks of the three parts in which the subject is divided.

EXAMINATION RULES.

Exam: It consists of different theoretical and practical questions related to the content of the subject.

BIBLIOGRAPHY

Basic:
- Lendlein, Andreas; Sisson, Adam L. Handbook of biodegradable polymers : synthesis, characterization and applications [on line]. Weinheim, Germany: Wiley-VCH, cop. 2011 [Consultation: 06/05/2020]. Available on: https://onlinelibrary.wiley.com/doi/book/10.1002/9783527635818. ISBN 9783527635825.
- Bastioli, Catia [ed.]. Handbook of biodegradable polymers. 2nd ed. Shrewsbury: Smithers Rapra Technology, 2014. ISBN 9781847355270.
- Alemán, Carlos; Bianco, Alberto; Venanzi, Mariano. Peptide materials : from nanostructures to applications [on line]. Chichester: John Wiley & Sons, 2013 [Consultation: 06/05/2020]. Available on: https://onlinelibrary.wiley.com/doi/book/10.1002/9781118592403. ISBN 9781118592403.