Course guide
295584 - 295PB013 - Nanotechnology

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: MASTER'S DEGREE IN POLYMERS AND BIOPLASTICS (Syllabus 2024). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 3.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: CARLOS ENRIQUE ALEMAN LLANSO

Others: Primer quadrimestre:
CARLOS ENRIQUE ALEMAN LLANSO - Grup: T1
CINDY LUISA ESCALONA GONZÁLEZ - Grup: T1
JORDI SANS MILÀ - Grup: T1

PRIOR SKILLS

Nanotechnology

LEARNING RESULTS

Knowledges:
K3. Identify the fundamentals of the processes of synthesis, manufacture, modification, use, recycling and degradation of polymers and biopolymers.
K1. Identify the molecular chemical structure of polymers and biopolymers.
K5. Relate the structure and properties of polymers and biopolymers in order to predict their behaviour and to obtain materials with new functionalities.
K2. Identify the physical principles that govern the behaviour of polymers and underlie many of the techniques used in polymer analysis.

Skills:
S5. Select polymers and biopolymers according to their properties and intended use.
S6. Design and optimise polymeric materials for specific applications.

Competences:
C3. Apply acquired knowledge and problem-solving skills both in discipline-specific environments and in new or unfamiliar environments in broader (or multidisciplinary) contexts related to the field of study.
C2. Apply appropriate methods of analysis, production and management in the field of polymers and biopolymers.
C4. Make effective use of information resources, managing the acquisition, structuring, analysis and visualisation of data and information within the field of specialisation and critically evaluating the results of this process.

TEACHING METHODOLOGY

Classes and presentation of works.

LEARNING OBJECTIVES OF THE SUBJECT

Learn basic knowledge related to the use of polymers and biopolymers in nanotechnology. Learn the concepts that relate the structure and properties of polymeric nanostructured materials.

STUDY LOAD

Type	Hours	Percentage
Hours large group	27,0	36.00
Self study	48,0	64.00

Total learning time: 75 h

CONTENTS

Introduction

Description:
Nanometric couplings. Specific interactions of coupling. Simple nanometric structures of molecules: geometric relations. Hierarchical structure. Methods of characterization of the nanostructure.

Specific objectives:
Acquire basic knowledge and theoretical foundations about nanotechnology.

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

Polymeric nanoparticles

Description:
Types of nanoparticles, synthesis of nanoparticles, characterization of nanoparticles, applications of nanoparticles.

Full-or-part-time: 11h
Theory classes: 11h

Polymeric nanomembranes

Description:
The materials for the manufacture of ultra-fine membranes. Preparation of ultra-fine membranes. Giant nanomembranes The functionalization of ultra-fine membranes. Applications of ultra-fine membranes in Electronics and Biomedicine.

Specific objectives:

Full-or-part-time: 11h
Theory classes: 11h

Polymeric nanofibers

Description:
Polymeric materials for the manufacture of nanofibres. Preparation of nanofibres. The functionalization of nanofibres. Applications of nanofibres.

Full-or-part-time: 11h
Theory classes: 11h

Polymeric nanogels

Description:
Hydrogels and nanogels. Properties and types. Applications of nanogels.

Full-or-part-time: 11h
Theory classes: 11h

Nanocomposites based on nanotubes, nanofibres, nanoparticles and nanosheets

Description:
Nanocomposites NTC-polymer. Manufacture, structure and properties of NTC. Optimization of dispersions. Natural and synthetic nanofibres. Dispersion strategies: superficial modifications and grafts. Silica and gold nanoparticles. Magnetic nanoparticles. Silicate-polymer nanocomposites. Laminated silicates. Interface effects: nanostructuring. Organic silicate modification. Methods for preparing nanocomposites. Modification of properties. Nanocomposite double hydroxides laminars-polymer. Graphene Nanocomposites.

Full-or-part-time: 11h
Theory classes: 11h

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+2·E)/6
where NC is the course mark, NP1-NP2 are the notes of the for parts in which the subject is divided and E is the mark of the exam.

EXAMINATION RULES.

Works and presentations drawn up by teams of two-three students depending on the number of students enrolled.
The written exam will be held individually at the end of the semester. It has a minimum of 70% attendance at the classes, in order to be able to reflect the preparation of the different Works assigned to teams.

RESOURCES

Other resources:
Supplied by the teaching staff.