

# Course guide

## 240EQ333 - 240EQ333 - Polymer and Biopolymer Nanotechnology

Last modified: 26/06/2025

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

**Degree:** **Academic year:** 2025 **ECTS Credits:** 4.5  
**Languages:** English

### LECTURER

**Coordinating lecturer:** CARLOS ENRIQUE ALEMAN LLANSO

**Others:** Primer quadrimestre:  
CARLOS ENRIQUE ALEMAN LLANSO - T10

### TEACHING METHODOLOGY

Classes are divided into lectures and discussion classes, in which the work done by the students is analyzed and discussed.

### LEARNING OBJECTIVES OF THE SUBJECT

Learn the basic skills related to the use of polymers and biopolymers in nanotechnology. Learn the concepts that relate the structure and properties of nanostructured materials for technological and biotechnological application.

### STUDY LOAD

Type	Hours	Percentage
Hours small group	40,5	36.00
Self study	72,0	64.00

**Total learning time:** 112.5 h

### CONTENTS

#### 1 Introduction: Principles and characterization.

**Description:**

Nanoscale particles and assemblies. Specific interactions assembly. Nanometric structures of simple molecules: geometric relationships. Hierarchical structuring. Environmental and toxicity. Characterization methods of the nanostructure: spectroscopy, microscopy and diffraction.

**Full-or-part-time:** 5h

Theory classes: 5h



## 2. Nanocomposites based on nanotubes, nanofibers and nanoparticles.

### Description:

NTC-polymer nanocomposites. Manufacturing, structure and properties of NTC. Optimization of the dispersions. Natural and synthetic nanofibers. Dispersal strategies: surface modification and grafting. Silica nanoparticles and gold. Magnetic nanoparticles. Modifying Properties.

**Full-or-part-time:** 5h

Theory classes: 5h

## 3. Nanocomposites based nanosheets

### Description:

Silicate-polymer nanocomposites. Phyllosilicates. Effects of interface: nanostructuring. Organic modification of silicates. Methods of preparation of nanocomposites. Modifying Properties. Layered double hydroxides nanocomposite polymer. Graphene Nanocomposites.

**Full-or-part-time:** 5h

Theory classes: 5h

## 4. Nanostructured polymers and copolymers.

### Description:

Design and synthesis of self-assembling polymers and copolymers. Polymer type and comb-type-brush. Block copolymers. Molecular structure and formation of nanostructured phases: phase diagrams. Properties and applications.

**Full-or-part-time:** 5h

Theory classes: 5h

## 5. Polymeric ultra-thin membranes

### Description:

Materials for the fabrication of ultra-thin membranes. Preparation of ultra-thin membranes. Giant free-standing nanomembranes. Functionalization of ultra-thin membranes. Applications of ultra-thin membranes in Electronics and Biomedicine.

**Full-or-part-time:** 5h

Theory classes: 5h

## 6. Polymeric nanofibers

### Description:

Polimeric materials for the fabrication of nanofibers. Preparation of nanofibers. Functionalization of nanofibers. Applications of nanofibers.

**Full-or-part-time:** 5h

Theory classes: 5h



## 7. Dendrimers and dendronized polymers

### Description:

Dendrimers and dendrons: Concepts and preparation. Synthesis and design of dendronized polymers. Functionalization of dendrimers and dendronized polymers. Molecular objects. Applications of dendrimers and dendronized polymers in Electronics and Biomedicine.

**Full-or-part-time:** 5h

Theory classes: 5h

## 8. Biopolymers mineralization

### Description:

Mineralization of biomolecules. Templating of minerals using biomolecules. Adsorption of biomolecules on inorganic surfaces. Encapsulation of biomolecules in inorganic minerals. Biomedical and biotechnological applications of biominerals: Transfection and tissue engineering.

**Full-or-part-time:** 5h 30m

Theory classes: 5h 30m

## GRADING SYSTEM

$$NC = 0.5 NC1 + 0.5 NC2$$

where NC is the course mark, and NC1 and NC2 are the notes of the first and second part of the course, respectively.

## EXAMINATION RULES.

Jobs: Different jobs to be developed by the students will be assigned during the course.

Examinations: Several theoretical and practical questions related with the topics explained along the course.

## RESOURCES

### Audiovisual material:

- Nom recurs. The resources required to follow the course will be provided by teachers.