Course guide
295702 - PCO - Plastic and Composites

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Spanish

LECTURER

Coordinating lecturer: ORLANDO ONOFRE SANTANA PEREZ

Others: ORLANDO ONOFRE SANTANA PEREZ - Teoría

REQUIREMENTS

FONAMENTS DE POLÍMERS - Precorequisite

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of science, technology and materials' chemistry fundamentals. Understanding the relation between microstructure, synthesis or processing and materials' properties.
2. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
3. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.

Transversal:
06 URI N3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

During the course there will be three types of sessions: theory, problems, and laboratory practices. In addition autonomous learning to relate knowledge acquired in practices with theoretical fundaments. Two exams will take place.

LEARNING OBJECTIVES OF THE SUBJECT

The objective is that the student acquires basic knowledge on the structure, properties, manufacturing, design and service behaviour of polymeric materials and composite materials.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
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<tr>
<td>Guided activities</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
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</table>
Total learning time: 150 h

CONTENTS

**Topic 1. Structure and classification of polymeric materials**

Description:
Aspects on evaluation and bibliography of the course.
History of polymer technology. Production and consumption. Market applications.
Monomer Vs. Copolymer.
Homopolymers Vs. Copolymers.
Idealization of macromolecules. Molecular conformations and configurations.
Molecular architecture.
Classification of polymeric materials according to the relationship between performance and architecture.

Related competencies:
- CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
- CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
- CE9. Knowledge of science, technology and materials' chemistry fundaments. Understanding the relation between microstructure, synthesis or processing and materials' properties.

**Full-or-part-time:** 4h 30m
Theory classes: 4h 30m

**TOPIC II: Plastics Technology**

Description:
Classification of plastic materials according to their molecular structure and to their consumption. Natural polymers. Description of plastic material families: polyolefines, styrenic, halogenated polymers, polyamides, linear polyesters, PMMA, POM. High performance polymers. Thermostables and elastomers. Polymers obtained from renewable sources and biodegradable (biopolymers). Additives.

Related competencies:
- CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
- CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
- CE9. Knowledge of science, technology and materials' chemistry fundaments. Understanding the relation between microstructure, synthesis or processing and materials' properties.

**Full-or-part-time:** 26h
Theory classes: 8h
Laboratory classes: 3h
Self study: 15h
TOPIC III: Structure-properties relation

Description:
Relation between structure and the following properties: mechanics, chemical, optical and electric. Service behaviour.

Related competencies:
CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
CE9. Knowledge of science, technology and materials' chemistry fundaments. Understanding the relation between microstructure, synthesis or processing and materials' properties.

Full-or-part-time: 20h
Theory classes: 7h
Practical classes: 1h
Self study: 12h

TOPIC IV: Thermoplastics processing technology

Description:

Related competencies:
CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
CE9. Knowledge of science, technology and materials' chemistry fundaments. Understanding the relation between microstructure, synthesis or processing and materials' properties.

Full-or-part-time: 47h
Theory classes: 13h
Practical classes: 3h
Laboratory classes: 3h
Self study: 28h
TOPIC V: Composite materials

Description:

Related competencies:
CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
CE9. Knowledge of science, technology and materials' chemistry fundamentals. Understanding the relation between microstructure, synthesis or processing and materials' properties.

Full-or-part-time: 23h
Theory classes: 5h
Practical classes: 1h
Laboratory classes: 3h
Self study: 14h

TOPIC VI: Environmental aspects

Description:
Post-consumption waste. Waste alternatives. Ecodesign principles. ACV. Primary, secondary, tertiary and quaternary recycling. Practical cases.

Related competencies:
CEM7. Knowledge and capacities to evaluate security, durability, and structural integrity of materials and components manufactured with these materials.
CEM5. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
CE9. Knowledge of science, technology and materials' chemistry fundamentals. Understanding the relation between microstructure, synthesis or processing and materials' properties.

Full-or-part-time: 20h
Theory classes: 5h
Laboratory classes: 3h
Self study: 12h

GRADING SYSTEM

3 partial exams (NPP-1; NPP-2 and NPP-3) + Continuous evaluation (NEC).

All evaluations will be on a scale of 10. IMPORTANT: ALL EVALUATION ITEMS ARE MANDATORY IN ORDER TO PASS THE SUBJECT.

The final grade (NF) will be calculated from the following expression:

$$NF = 0.7N_{Theory} + 0.3NEC \text{ (Continuous Assessment)}$$

$$N_{Theory} = \text{average of the 3 partial tests}$$

$$\text{In case of } N_{Theory} \text{ } N_{Theory} = 0.3 \times \text{(Average Partial Tests)} + 0.7 \times EF$$
EXAMINATION RULES.

The partial exams (ExPr) will be done within the schedule of the subject. No notes, unless instructed to do so by the teacher. They will have a maximum duration of 75 min.

Laboratory reports will be presented in groups of up to 3 students one week after the session. A template for writing will be available.

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Educational material available in ATENEA.