Course guide
240IMA21 - 240IMA21 - Design, Ecodesign and Recycling

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING (Syllabus 2021). (Optional subject).
Academic year: 2023
ECTS Credits: 4.5
Languages: Spanish, English

LECTURER

Coordinating lecturer: NOEL LEÓN ALBITER
Others: MARIA LLUÍSA MASPOCH RULDUA

TEACHING METHODOLOGY

Presentation of master classes, directed activities and laboratory sessions in order to provide the necessary and sufficient knowledge to allow an adequate and efficient understanding of the subject.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student should be able to understand the basic aspects related to optimization, recycling, and alternatives in the use of plastic materials.

Specific objectives include:
- To know the design principles that make material optimization possible during the manufacture of a plastic part.
- To know the main characteristics of polymeric materials and biopolymers.
- To understand the main ways of recycling plastic materials.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>72,0</td>
<td>64.00</td>
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<tr>
<td>Hours large group</td>
<td>27,0</td>
<td>24.00</td>
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<tr>
<td>Hours small group</td>
<td>13,5</td>
<td>12.00</td>
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Total learning time: 112.5 h
## CONTENTS

### T1. Introduction

**Description:**
- Basic concepts about plastic materials
- Processing methods (injection molding)

**Related activities:**
Master class

**Full-or-part-time:** 10h 30m
- Theory classes: 3h
- Self study: 7h 30m

### T2. Plastic design principles

**Description:**
- Introduction
- Thickness effect
- Stress concentrators
- Ribs and reinforcements
- Demolding

**Related activities:**
Master class

**Full-or-part-time:** 9h 30m
- Theory classes: 3h
- Self study: 6h 30m

### T3. CAD-CAE, plastic parts examples

**Description:**
- Background
- Advantages
- Most used programs
- Practical examples

**Related activities:**
Master class

**Full-or-part-time:** 9h 10m
- Theory classes: 2h
- Self study: 7h 10m
<table>
<thead>
<tr>
<th><strong>T4. Waste, alternatives to waste and ecodesign principles</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- Demand and production of plastics</td>
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<tr>
<td>- Plastic waste: Industrial and post-consumer</td>
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<tr>
<td>- Alternatives to plastic waste: the 3Rs rule</td>
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<tr>
<td>- Ecodesign strategies</td>
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<tr>
<td><strong>Related activities:</strong></td>
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<tr>
<td>Master class</td>
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<tr>
<td><strong>Full-or-part-time:</strong></td>
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<tr>
<td>9h 30m</td>
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<tr>
<td>Theory classes: 2h</td>
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<tr>
<td>Self study : 7h 30m</td>
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<tr>
<th><strong>T5. Plastic recycling</strong></th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- Mechanical recycling</td>
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<tr>
<td>- Polymer degradation</td>
</tr>
<tr>
<td>- Chemical recycling</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
</tr>
<tr>
<td>Master class</td>
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<tr>
<td><strong>Full-or-part-time:</strong></td>
</tr>
<tr>
<td>9h 30m</td>
</tr>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Self study : 7h 30m</td>
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<tr>
<th><strong>T6. ACV - Activity: CES edupack</strong></th>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- Introduction</td>
</tr>
<tr>
<td>- Evolution</td>
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<tr>
<td>- Program operation</td>
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<tr>
<td>- Activity</td>
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<tr>
<td><strong>Related activities:</strong></td>
</tr>
<tr>
<td>Master class</td>
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<tr>
<td><strong>Full-or-part-time:</strong></td>
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<tr>
<td>12h 50m</td>
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<tr>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study : 7h 50m</td>
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</tbody>
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T7. Practical cases of recycling plastics + bioplastics

Description:
- Examples of revaluation of plastics
- Biodegradation
- Life cycle/carbon footprint
- Main biopolymers

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study: 6h 30m

T8. Rubber recycling

Description:
- Introduction
- Natural and synthetic rubbers
- Mechanical recycling
- Chemical recycling

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study: 6h 30m

T9. Laboratory sessions

Description:
- Fast identification techniques for plastics
- Injection of plastic materials

Related activities:
Team work

Full-or-part-time: 10h
Laboratory classes: 10h

T10. Metals recycling

Description:
- Relevance of recycling
- Recyclable metals
- Recycling processes

Related activities:
Master class

Full-or-part-time: 9h 30m
Theory classes: 3h
Self study: 6h 30m
T11. Work presentations

**Description:**
- Selection of scientific papers of interest
- Presentation/exposition of the main results

**Full-or-part-time:** 13h
  - Theory classes: 3h
  - Self study : 10h

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**GRADING SYSTEM**

The final score will correspond to:
0,47*Final exam + 0,17*Seminars + 0,16*Activity + 0,1*Works + 0,1*Laboratory sessions

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**BIBLIOGRAPHY**

**Basic:**

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**RESOURCES**

**Other resources:**
Teaching material available in Atenea