320058 - TMP - Plastic Materials Technology

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2018
Degree: BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: English

Teaching staff

Coordinator: MARCELO DE SOUSA PAIS ANTUNES
Others: MIGUEL ANGEL SANCHEZ SOTO - DAVID ARENCON OSUNA

Degree competences to which the subject contributes

Transversal:
1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
3. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology

- Attending classes of exposition of the contents.
- Attending classes of practical work.
- Autonomous work of study and preparation of written reports.
- Autonomous work of study and preparation of oral presentations.
- Preparation and fulfillment of group activities.

In the attending classes of exposition of the contents, the teacher will introduce the theoretical bases of the subject, concepts, methods and results, illustrating them with convenient examples.

The practical classes will be focused on showing to the students the main thermoplastic processing techniques, as well as some of the quality control tests commonly used in the industry.

Learning objectives of the subject

The main goal of this subject consists in setting the bases for understanding the main technologies used in the fabrication of plastic components based on thermoplastic materials (extrusion, injection molding, thermoforming, rotational molding, etc), as well as the influence of processing on the final properties of the component.

It is also an objective to develop the capability of the student to choose, according to a specific work-study component, the most suitable material and processing method for its production.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 30h</th>
<th>20.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
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<td>Hours small group: 30h</td>
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<td></td>
<td>Guided activities: 0h</td>
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<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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</table>
# Content

<table>
<thead>
<tr>
<th>TOPIC 1: Thermoplastic materials</th>
<th>Learning time: 11h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>- Definition of thermoplastic</td>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>material</td>
<td>Self study: 4h</td>
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<tr>
<td>- Types of thermoplastic materials according to structure</td>
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<tr>
<td>- States of aggregation of</td>
<td></td>
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<tr>
<td>polymers: amorphous/semi-crystalline polymers. Crystallinity</td>
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<tr>
<td>- Molecular weight</td>
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<tr>
<td>- Main families of thermoplastic</td>
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<tr>
<td>materials</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
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<tr>
<td>Activity 4</td>
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</table>

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<tr>
<th>TOPIC 2: Rheology</th>
<th>Learning time: 8h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 2h</td>
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<tr>
<td>- The concept of</td>
<td>Laboratory classes: 4h</td>
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<tr>
<td>viscosity</td>
<td>Self study: 2h</td>
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<tr>
<td>- Influence of</td>
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<tr>
<td>temperature,</td>
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<td>pressure and</td>
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<td>nature of the</td>
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<td>material on the</td>
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<tr>
<td>viscosity</td>
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<tr>
<td>- Rheology curves</td>
<td></td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
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<tr>
<td>Activity 1</td>
<td></td>
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<tr>
<td>Activity 2a</td>
<td></td>
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<tr>
<td>Activity 4</td>
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</tbody>
</table>
# TOPIC 3: Extrusion

**Description:**
- Definition of extrusion
- Basic elements of an extrusion line
- The extruder
- The extrusion screw
- Analysis of the extrusion process
- Extrusion-based processes
  - Extrusion of profiles and production of polymer fibres
  - Cast-sheet and cast-film extrusion
  - Extrusion blown-film
  - Extrusion coating and lamination
  - Co-extrusion
  - Extrusion blow-molding

**Related activities:**
- Activity 1
- Activity 2a
- Activity 3
- Activity 4

**Learning time:** 51h
- Theory classes: 8h
- Laboratory classes: 8h
- Self study: 35h

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# TOPIC 4: Thermoforming

**Description:**
- Definition of thermoforming
- Elements of a thermoforming line
- Thermoforming processes
- Main thermoforming applications

**Related activities:**
- Activity 1
- Activity 2a
- Activity 3
- Activity 4

**Learning time:** 8h
- Theory classes: 2h
- Laboratory classes: 2h
- Self study: 4h
**TOPIC 5: Injection molding**

**Learning time:** 72h
- Theory classes: 15h
- Laboratory classes: 12h
- Self study: 45h

**Description:**
- Definition of injection molding
- The injection molding machine
- The injection molding cycle
- PvT curves
- Analysis of the parameters of injection molding
- Defects in injection-molded plastic components
- Transformation processes based on conventional injection molding

**Related activities:**
- Activity 1
- Activity 2b
- Activity 3
- Activity 5
### Planning of activities

| ACTIVITY 1: LAB CLASSES | Hours: 30h  
Laboratory classes: 30h |
<table>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Lab/practical classes carried out in the facilities of the Centre Català del Plàstic.</td>
</tr>
</tbody>
</table>
| **Support materials:**  | Lab guidelines/content.  
Recommended bibliography.  
Other sources: books, articles, internet, etc. |
| **Descriptions of the assignments due and their relation to the assessment:** | Compulsory assistance. |
| **Specific objectives:**| To get acquainted with the main existing processing technologies of thermoplastic materials. |

| ACTIVITY 2a: LAB REPORTS - FIRST PART (INDIVIDUAL WORK) | Hours: 15h  
Self study: 15h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Each student will prepare an individual report according to the basic guidelines given in class by the teacher corresponding to each of the lab/practical classes carried out in the facilities of the Centre Català del Plàstic.</td>
</tr>
</tbody>
</table>
| **Support materials:**                                  | Lab guidelines/content (first part).  
Recommended bibliography.  
Other sources: books, articles, internet, etc. |
| **Descriptions of the assignments due and their relation to the assessment:** | Individual written reports. |
| **Specific objectives:**                                | To learn about the preparation of lab reports and develop the student's knowledge regarding the main existing processing technologies of thermoplastic materials. |

| ACTIVITY 2b: LAB REPORTS - SECOND PART (INDIVIDUAL WORK) | Hours: 15h  
Self study: 15h |
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</tr>
</tbody>
</table>
| **Support materials:**                                  | Lab guidelines/content (second part).  
Recommended bibliography.  
Other sources: books, articles, internet, etc. |
| **Descriptions of the assignments due and their relation to the assessment:** | Individual written reports. |
### Specific objectives:
The students will prepare in groups formed by 3/4 students a report about a given subject directly related with the processing of thermoplastic materials, selected from a list of possible subjects prepared by the teacher or proposed by the students.

**ACTIVITY 3: WORK REPORT/PRESENTATION (GROUP WORK)**

**Description:**
The students will prepare in groups formed by 3/4 students a report about a given subject directly related with the processing of thermoplastic materials, selected from a list of possible subjects prepared by the teacher or proposed by the students.

**Support materials:**
- Recommended bibliography.
- Other sources: books, articles, internet, etc.

**Descriptions of the assignments due and their relation to the assessment:**
- Written report and oral presentation.

**Specific objectives:**
The main objective of this work is to develop the student's capability of looking for recent and useful information related to the processing technologies of plastic materials using different sources.

Contribute to teamwork consolidation and favouring the communication and distribution of group tasks.

**Hours:** 16h  
Theory classes: 2h  
Self study: 14h

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### ACTIVITY 4: FIRST EXAMINATION

**Description:**
Written exam in which the student will have to show his/her knowledge of the contents learned in class.

**Descriptions of the assignments due and their relation to the assessment:**
- Written exam.

**Specific objectives:**
To develop the contents learned in the theoretical and practical classes and demonstrate the level of knowledge.

**Hours:** 7h  
Theory classes: 2h  
Self study: 5h

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### ACTIVITY 5: SECOND EXAMINATION

**Description:**
Written exam in which the student will have to show his/her knowledge of the contents learned in class.

**Descriptions of the assignments due and their relation to the assessment:**
- Written exam.

**Specific objectives:**
To develop the contents learned in the theoretical and practical classes and demonstrate the level of knowledge.

**Hours:** 7h  
Theory classes: 2h  
Self study: 5h
### Qualification system

The final degree of the subject will depend on the following evaluation activities:

- Activity 2a: 17.5%
- Activity 2b: 17.5%
- Activity 3: 15%
- Activity 4: 25%
- Activity 5: 25%

### Regulations for carrying out activities

- Activity 2a: individual written reports
- Activity 2b: individual written reports
- Activity 3: written report and oral presentation (group work)
- Activity 4: written exam
- Activity 5: written exam

### Bibliography

#### Basic:


#### Complementary:


#### Others resources:

Information placed in Atenea (intranet)