340201 - MPAF-M7P02 - Advanced Manufacturing Materials and Processes

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2019
Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6  
Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: SERGI MENARGUES MUÑOZ
Others: SERGI MENARGUES MUÑOZ

Degree competences to which the subject contributes

Specific:
1. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.
2. D51. Ability to identify used machines and its parameters to control in each process.
3. D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.
4. D53. Ability to associate possibilities to design in each fabrication process.

Transversal:
5. 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.
6. 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.
7. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Teaching methodology

- Attending sessions of exposition of contents.
- Attending sessions of practical work (resolution of exercises).
- Attending sessions of practical work in working groups (practices of laboratory).

The professor will introduce the theoretic bases of the matter of the manufacturing processes in the sessions of exposition of contents.
The professor will guide the student in the understanding of the theoretic concepts in the sessions of resolution of exercises, likewise, the oral communication by means of the presentation will be worked up and resolution in public of the proposed problems.
The ability of work in team will develop in the sessions of laboratory.

In the out-class activities the professor supervises the student's work by means of the analysis of his evolution through the evaluation activity and the guided activities.
Learning objectives of the subject

(ENG)
1. To describe the basics of manufacturing processes for the transformation of metals, polymers and ceramic.
2. To know the dimensional and superficial metrology's basics and its relation in validation and verification of the different processes of manufacture.
3. To identify the utilized machinery and parameters to control the different processes.
4. To select, to design and to optimize the best-suited manufacturing processes in terms of the design, material, use of the part and environmental impact.
5. To correlate the designing possibilities to each manufacturing process.
6. Knowing and designing the management of quality of processes and products.
7. Learning the knowledge about physical properties that they allow defining him the specifications.
8. Applying the methodology of selection of materials and its processes.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
<td></td>
<td>Hours small group: 15h</td>
<td>10.00%</td>
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<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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<tr>
<td>Content</td>
<td>Learning time: 13h</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td><strong>1: Metrology and quality in manufacturing processes</strong></td>
<td>Theory classes: 4h</td>
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<td></td>
<td>Laboratory classes: 2h</td>
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<td></td>
<td>Guided activities: 0h 30m</td>
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<td></td>
<td>Self study : 6h 30m</td>
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**Description:**
1.1 The metrology and measurement systems. Uncertainties of measurement. Systems of management of measures. 1.2. Product design and process selection.

**Related activities:**
- Activity 1: informative class
- Activity 2: Content's exercises1
- Activity 3: Product and Process Controls practical
- Activity 12: Partial exam 1.
- Activity 25: Final exam.

<table>
<thead>
<tr>
<th>Content</th>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td><strong>2: Solidification and casting processes</strong></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Practical classes: 0h</td>
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<tr>
<td></td>
<td>Laboratory classes: 3h</td>
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<td></td>
<td>Guided activities: 0h 30m</td>
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<tr>
<td></td>
<td>Self study : 10h 30m</td>
</tr>
</tbody>
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**Description:**
2.1. Solidification mechanism. 2.2. Casting materials. 2.3. Design of products for manufacturing: shaping castings design and mould design. 2.4. Major casting techniques. 2.5. High pressure die casting 2.6. Semisolid processes.

**Related activities:**
- Activity 4: informative class
- Activity 5: Content’ 2 exercises
- Activity 6: Aluminium casting practice
- Activity 7: Solidification microstructures practice
- Activity 12: Partial exam 1.
- Activity 25: Final exam.
### 3: Joining processes

**Learning time:** 25h
- Theory classes: 7h
- Practical classes: 0h
- Laboratory classes: 3h
- Guided activities: 0h 30m
- Self study: 14h 30m

**Description:**
3.1 Joining processes: welding  
3.2 Metallurgical phenomena: metals' weldability.  
3.3 Welding processes.  
3.4 Adhesives and fasteners

**Related activities:**
(ENG) Activity 8: informative class  
Activity 9: Content' 3 exercises  
Activity 10: Welding practice  
Activity 11: Joining microstructures practice  
Activity 12: Partial exam 1  
Activity 25: Final exam

### 4: Forming processes

**Learning time:** 24h
- Theory classes: 8h
- Practical classes: 0h
- Laboratory classes: 2h
- Guided activities: 0h 40m
- Self study: 13h 20m

**Description:**
4.1 The origin, nature and utilisation of plastic flow.  
4.2 Temperatures and Processes. Materials formability.  

**Related activities:**
(ENG) Activity 13: informative class  
Activity 14: Content' 4 exercises  
Activity 15: Sheet forming practice  
Activity 24: Partial exam 2  
Activity 25: Final exam
### 5: Machining processes

**Learning time:** 13h  
- Theory classes: 3h 30m  
- Practical classes: 0h  
- Laboratory classes: 2h  
- Guided activities: 0h 30m  
- Self study: 7h

**Description:**  

**Related activities:**  
(ENG) Activity 16: informative class  
Activity 17: Content' 5 exercises  
Activity 18: CNC programming practice  
Activity 24: Partial exam 2  
Activity 25: Final exam

### 6: Powder metallurgy and Surface processes

**Learning time:** 11h  
- Theory classes: 6h  
- Practical classes: 0h  
- Guided activities: 0h 30m  
- Self study: 4h 30m

**Description:**  
6.1 Powder metallurgy: Design Consideration. 6.2 Surface engineering.

**Related activities:**  
(ENG) Activity 149: informative class  
Activity 20: Content' 6 exercises  
Activity 24: Partial exam 2  
Activity 25: Final exam
7: Processing of plastics and composites materials

Learning time: 24h
- Theory classes: 6h 30m
- Practical classes: 0h
- Laboratory classes: 2h
- Guided activities: 0h 45m
- Self study: 14h 45m

Description:

Related activities:
(ENG) Activity 21: informative class
Activity 22: Content 7 exercises
Activity 23: Electroplating on plastic practice
Activity 24: Partial exam 2
Activity 25: Final exam

Qualification system

The evaluation of the course will become according to the following indicators:

T, Theory: average mid-term exam 1 and mid-term exam 2.
P, Solves exercises: Average of the different made exercises.
L, Practices of laboratory: Weighted average of the different programmed practices.
F, Final Exam.

The grade of the course will be obtained applying the most favourable one of the following scale:

1. Final grade = 0.6T + 0.1P + 0.3L
2. Final grade = 0.6F + 0.1P + 0.3L

The laboratory practices, the tests carried out via Campus Digital and the activities carried out in the classroom during the regular period of classes (problems and / or presentations of work) will not be re-evaluated.

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition for the approval of the subject. It will also be a necessary condition to have participated in, at least, 75% of the presentations made in the classroom and to have made the evaluations of them.
Bibliography

Basic:


Complementary:


Others resources:

Hyperlink

Multilingual dictionary of basic and general terms in metrology

http://www.efunda.com/home.cfm
Online Reference for Engineers

http://www.sme.org/cgi-bin/getsmepp.pl?/communities/education/edu_community_hp.htm&&&SME&
Manufacturing Education & Research Community

IA TE, Inter-Active Terminology for Europe, is the EU inter-institutional terminology database.